



# River Systems Management Workshop

*Addressing Water Conflict*

Hosted By:  
Technical Service Center  
Bureau of Reclamation

November 4-6, 2003  
Holiday Inn University Park  
Fort Collins, Colorado



**RIVER SYSTEMS MANAGEMENT WORKSHOP**  
*Addressing Water Conflict*

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**Tuesday - November 4**  
**Idaho Room**

- 1:00 p.m.     *Introduction and Welcoming Remarks*  
**Don Frevert**, Technical Service Center
- 1:15 p.m.     *Keynote Address*  
**William E. Rinne**, Deputy Commissioner, Operations
- 2:15 p.m.     Break
- 2:45 p.m.     *Hot Topics in Water Resources Management (Don Frevert, Moderator)*
- MP – Operations Criteria and Plan (OCAP) 5 Species ESA Consultation  
      **Ann Lubas-Williams**, Special Assistant, Central Valley Operations Office
  - PN – *Federal Columbia River Power System Biological Opinion*  
      **Jim Fodrea**, Acting Manager, Columbia/Snake Salmon Recovery Office
  - LC – *Lower Colorado River Water Allocations (CA 4.4 MAF)*  
      **Terry Fulp**, River Operations Manager, Boulder Canyon Operations Office
  - UC – *Middle Rio Grande ESA Collaborative Program*  
      **Jim Wilber**, Program Manager, Albuquerque Area Office
  - GP – *Colorado Big Thompson and Upper Colorado Issues*  
      **Brian Person**, Area Manager, Eastern Colorado Area Office
- 4:30 p.m.     Adjourn
- 5:00 p.m.     Demonstrations and Poster Exhibits  
                 **Arizona/Oregon Room**
- 7:00 p.m.     Adjourn for the Evening

## Wednesday - November 5

### 7:30 a.m. – Continental Breakfast – Arizona/Oregon Room (Poster Exhibits on Display)

#### Idaho Room

- 8:00 a.m.     *General Session 1 - Legal Issues Related to Water Use (Bruce Williams, Moderator)*
- *California's 4.4 MAF of Colorado River Water*  
      **Bob Snow**, Office of the Solicitor
  - *Middle Rio Grande Minnow vs. USBR Litigation*  
      **Megan Walline**, Office of the Solicitor
  - *Department of Justice Water Perspective*  
      **Jim Dubois**, U.S. Department of Justice
- 10:00 a.m.     Break
- 10:30 a.m.     *General Session 2 - Agricultural vs Urban Uses (Karen Barnett, Moderator)*
- **Bill Luce**, Manager, South-Central California Area Office
  - **Dick Wolfe**, Colorado Division of Water Resources
- 12:00 noon     Working Lunch – **Arizona-Oregon Room**  
                    *Addressing Water Conflict*  
                    **Daniel P. Loucks**, Cornell University
- 1:30 p.m.     *Breakout Session Series 1*
- **Daniel P. Loucks**, Cornell University  
         *New Technology in Water Resources Management*  
         *(Assisting: Kip Gjerde)*
  - **Neil Grigg**, Colorado State University  
         *Federal vs. State Water Resources Issues*  
         *(Assisting: Don Frevert)*
  - **Chris Jansen-Lute**, Acting Program Manager, Water Resources  
         *Ecologically Based System Management Project (EBSM)*  
         *(Assisting: Ann Lubas-Williams)*
  - **Shane Coors**, Graduate Student  
         *Real-time Flow Forecast Model*  
         *(Assisting: Karen Barnett)*
- 3:00 p.m.     Break

### **Wednesday - November 5 (cont.)**

- 3:30 p.m. *Breakout Session Series 2*
- **Darrell Fontane**, Professor, Colorado State University  
*Water Resource Modeling and Optimization*  
(Assisting: *Leslie Stillwater*)
  - **Robert Ward**, Director, Colorado Water Resources Research Institute  
*Collaboration in Water Data Collection and Sharing*  
(Assisting: *Jeff Rieker*)
  - **Aaron Wolf**, Associate Professor of Geography, Oregon State University  
*Practicum in Water Conflict Resolution: Lessons from Around the World*  
(Assisting: *Kip Gjerde*)
- 5:00 p.m. Adjourn for the Evening

### **Thursday - November 6**

**7:30 a.m. – Continental Breakfast – Arizona/Oregon Room**  
**(Poster Exhibits on Display)**

#### **Idaho Room**

- 8:00 a.m. *Breakout Summaries (Gordon Aycock, Moderator)*
- 8:45 a.m. *General Session 3 - Native American Water Issues (Ann Lubas-Williams, Moderator)*
- **Chris Kenney**, Director, Native American Affairs
  - **Ron Eggers**, Area Manager, Lower Columbia Area Office
  - **Jim Berkley**, Environmental Protection Agency
- 10:15 am Break
- 10:45 a.m. Open Microphone – Reclamation Managers Panel  
*Future Priorities for River System Management (Mike Gabaldon, Moderator; Leslie Stillwater, Assisting)*
- **William E. Rinne**, Deputy Commissioner, Operations
  - **William H. Luce**, Area Manager, South Central California Area Office, Mid-Pacific Region
  - **J. William McDonald**, Pacific Northwest Regional Director
  - **Connie L. Rupp**, Upper Colorado Assistant Regional Director
  - **Robert W. Johnson**, Lower Colorado Regional Director
  - **Jari Beek**, Great Plains Deputy Regional Director
- 11:25 a.m. Questions/Answers from audience
- 12:00 noon Adjourn



**Optional Field Trip**  
**Thursday, November 6**  
***Big Thompson, A Reclamation River –***  
***The Colorado-Big Thompson Project***

- 12:30 p.m. Meet at Hotel entrance; leave for Estes Park
- 1:15 p.m. Arrive Estes Power Plant, Estes Park.  
Introduction to Bureau of Reclamation and Colorado-Big Thompson Project  
*Speaker, TBA*
- 1:30 p.m. Begin Estes Power Plant Tour  
*Tour Guide, TBA*
- 2:30 p.m. Conclude Estes PP tour
- 2:35 p.m. Leave for East Portal
- 2:45 p.m. Arrive East Portal. Talk briefly about Alva B. Adams Tunnel  
*TBA*
- 3:30 p.m. Leave East Portal
- 3:35 p.m. Arrive Mary's Lake. Talk about Mary's Lake  
*TBA*
- 3:50 p.m. Leave for Trifurcation—discuss Dille Diversion on way down canyon  
*TBA*
- 4:20 p.m. Arrive at Dam Store/ Lower Trifurcation  
*TBA*
- 4:40 p.m. Leave Trifurcation for Horsetooth Reservoir on return to Ft. Collins
- 5:00 p.m. Arrive Horsetooth Reservoir. Drive around South Bay, over Spring Canyon Dam,  
down to Overland Trail and Prospect Road  
*TBA: Talk about completed SOD work*
- 5:30 p.m. Conclude Tour/Arrive back at Holiday Inn

## Demonstrations/Posters

*Climate Change Considerations in Long Range Reclamation Planning*

**Levi Brekke**, Water Resources Modeler,  
MP Region

*EBSM (Ecologically Based System Management)*

**Chris Jansen-Lute**, Acting Program  
Manager, Water Resources, PN Region

*Geomorphology Study on the Gila River*

**Jeanne Klawon**, Geomorphologist,  
Technical Service Center

*Graphical Policy Analysis Tool*

**Dave King**, Technical Service Center  
**Tim Magee**, Operations Research Analyst,  
CADSWES

*Kansas-Nebraska-Colorado Groundwater Model*

**Mark Phillips**, Geologist, Great Plains  
Region

*MODSIM*

**John Labadie**, Colorado State University

*Optimization Technology*

**Darrell Fontane**, Professor  
Colorado State University

*PISCES*

**Leslie Stillwater**, Planning and Operations  
Modeler, PN Region

*Real-time Flow Forecast Model*

**Shane Coors**, Graduate Student

*RiverWare*

**Edith Zagona**, Director, CADSWES

*Stochastic Hydrology*

**Pepe Salas**, Professor  
Colorado State University

*Trinity Restoration*

**Doug Schleusner**, Executive Director  
Northern California Area Office

*WaTER Group River Systems Projects*

**Michelle Chapman/Susan Martella**  
Technical Service Center

*Web Visualization*

**Jeff Rieker**, Hydraulic Engineer  
Technical Service Cent

## BIOGRAPHICAL SKETCH

**Gordon Aycock**  
Technical Specialist  
Great Plains Regional Office  
Bureau of Reclamation

Gordon Aycock has worked for the Bureau of Reclamation as a Hydraulic Engineer since 1972. During 1981 to 1989 he was chief of the Reservoir Regulation Branch, initially for the Upper Missouri Region and then later for the Missouri Basin Region when the Lower and Upper Missouri Regions were combined in 1985. In this capacity Gordon was directly responsible for the operation of 25 reservoirs in the region. In 1989 the Missouri Basin Region was combined with the Southwest Region to become the Great Plains Region. At that time Gordon became the Chief of the Water Management Branch in the Division of Water, Land and Power, Great Plains Regional Office. Since 1995, Gordon has served as a Technical Specialist in the Water Resources Group of the Great Plains Regional Office and is currently responsible for overseeing reservoir operations and water rights for the Region. Gordon graduated from Utah State University in 1971 with a B.S. degree in Mechanical Engineer. He is a registered Professional Engineer in the State of Montana.



## BIOGRAPHICAL SKETCH

**Karen E. Barnett**  
Wildlife Biologist  
Upper Colorado Region  
Bureau of Reclamation

Karen Barnett is currently a wildlife biologist in the Bureau of Reclamation's Upper Colorado Regional Office. She has been with Reclamation for four years. Her work involves listed and sensitive riparian and wetland species, oversight of research on riparian ecosystems and other research projects, and oversight of the Wetlands Development Program.

Karen began her natural resources career with the U.S. Forest Service in Wyoming, working on wilderness management issues. She has worked for the Water Quality Division of the Vermont Department of Environmental Quality as well as the Environmental Contaminants Division of the U.S. Fish and Wildlife Service.

Karen received her B.S. in Biology at Appalachian State University in North Carolina in 1984.

## BIOGRAPHICAL SKETCH

**Jaralyn (Jari) Beek**  
Deputy Regional Director  
Great Plains Region

Jaralyn (Jari) Beek was named Deputy Regional Director for the Bureau of Reclamation's Great Plains Region in Billings, Montana, on August 18, 2003.

Ms. Beek was the Manager of the Resource Services Group in the Great Plains Regional Office in Billings from November 2000 thru August 2003. In that position she oversaw environmental, land and resource issues in the support of the operation of the region's facilities.

Ms. Beek also served as the Deputy Manager of the Nebraska-Kansas Area Office in Grand Island, Nebraska, between April 1996 and November 2000.

Ms. Beek received a bachelor's degree from Western State College, Gunnison, Colorado, and a master's degree in public administration with an emphasis in environmental law and policy at University of Colorado, Denver. Her first 3 ½ years of federal service was with the Veteran's Administration. She then worked for the Bureau of Mines, Bureau of Land Management, and Minerals Management Service before joining the Bureau of Reclamation in the Denver Office in April of 1991.

## BIOGRAPHICAL SKETCH

### **Levi Brekke**

Water Resources Modeler  
Planning Division  
Mid-Pacific Regional Office  
Bureau of Reclamation

Levi Brekke began working for Reclamation as a hydrologist and water resources modeler in May, 2003. His responsibilities include reservoir systems modeling using CALSIM II, statistical analyses, risk analysis, technical review, and briefing. Recent highlights include:

- implementing refinements to the Environmental Water Account (EWA) module in CALSIM II, and coordinating applications of the refined module to support (a) long-term programmatic design by the 5 agencies managing EWA operations; and (b) development of a modeling description for the Central Valley Project Operations Criteria and Plan (OCAP).
- working with CVO-Power to develop load forecasting schemes for the VISTA project for 7-day hourly schedules, 14-day hourly schedules, and 2-year monthly schedules; Reclamation-MP will begin bearing the financial risks of CVP hourly load scheduling in CY2005.
- representing Reclamation on a climate change working group hosted by the California Department of Water Resources.

From 1998-2003, Levi was a doctoral student at UCLA (98-00) and at UC-Berkeley (00-03). His dissertation work was in the area of seasonal to interannual climate forecasting and assessing the value of climatic teleconnections for the sake of annual operations planning. His research assistantship at UC-Berkeley was in the area of climate change impacts assessment. That work involved using CALSIM II to study the uncertainties of climate change impacts on the water resources of the San Joaquin River Basin in California (i.e. southern portion of the Central Valley Project). His assistantship at UCLA focused on lidar remote sensing of water vapor to study evapotranspiration phenomena at high spatial resolutions.

Levi's work experience also includes engineering consulting in the areas of wastewater and water treatment from 1995-1998. His education includes a PhD in Environmental Engineering from UC-Berkeley (2003), an M.S. in Environmental Engineering and Science from Stanford University (1995), and a B.S. in Civil Engineering from The University of Iowa (1994).



## BIOGRAPHICAL SKETCH

**James J. DuBois, Attorney**  
Natural Resources Section  
Environment and Natural Resources Division  
U.S. Department of Justice  
Denver, Colorado

James J. DuBois is a trial attorney in the Natural Resources Section, Environment and Natural Resources Division, U.S. Department of Justice. He has spent the last twelve years in the Denver Office of the Environment and Natural Resources Division. Prior to joining the Department of Justice, he spent seven years in private practice, primarily involved in water rights issues. Jim graduated cum laude from Northwestern School of Law, Lewis and Clark College in 1983, and got his undergraduate degree in 1976 from St. Olaf College

Jim has represented the United States in water rights adjudications and other cases involving natural resources and public land issues throughout the west, including interstate compact litigation involving interests of the Bureau of Reclamation. Presently he is representing the United States in numerous cases involving water rights in Colorado, Montana, and Idaho.

## BIOGRAPHICAL SKETCH

### **Jim Fodrea**

Acting Manager, Columbia/Snake Salmon Recovery Office  
Pacific Northwest Region

Jim Fodrea has been involved in Columbia and Snake River reservoir system operation and planning since 1974. His water management career includes 12 years with the Corps of Engineers in Portland, Oregon, and 4 years with Grant County Public Utility District in Ephrata, Washington. He has been with the Bureau of Reclamation in Portland, Oregon, Washington, D.C., and Boise, Idaho, since 1990.

He is presently the acting Program Manager for the Columbia Snake Salmon Recovery Office in Reclamation's Pacific Northwest Regional Office in Boise. He is responsible for the implementation of measures to help recover Columbia and Snake River salmon and steelhead.

He is a Boise native, civil engineering graduate of the University of Idaho, and a registered professional engineer in Idaho.

## BIOGRAPHICAL SKETCH

### **Darrell G. Fontane**

Professor & Director of the International School for Water Resources

Professional Engineer

Department of Civil Engineering

Colorado State University

**Dr. Fontane** is the Director of the International School for Water Resources and a Professor in the Civil Engineering Department at Colorado State University. His areas of interests are water resources decision support systems, computer aided water management and integrated water quantity and quality management. As Director of the International School for Water Resources, he is responsible for organizing and administering special, non-degree training for international engineers in various aspects of water resources engineering. Dr. Fontane has personally conducted water resources training in eight countries.

As a member of the Water Resources Planning and Management Program of the Civil Engineering Department, he performs graduate teaching and research in the areas of water resources systems analysis and computerized decision support systems for water resources management. He has served as principal or co-principal investigator for research projects on topics such as: Methodologies to Improve Regional Exchange of Hydropower Resources, Stochastic Analysis of Project Dependable Capacity in Hydropower Systems, Optimal Design and Operation of Selective Withdrawal Structures, Optimal Selection of Salinity Control Measures in the Colorado River Basin, Developing Alternative Operation Strategies for the Colorado River Basin, Evaluation of the Lake Nasser Optimization Models, Development of Methods to Assess Alternative Water-based Recreational Strategies, Development of a General Reservoir Decision Support System and Optimal Operation of a System of Lakes for Quantity and Quality. These projects have been funded by the World Bank, U.S. Agency for International Development, U.S. National Park Service, U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, U.S. Department of Energy--Western Area Power Administration, and the Korea Center for Water Resources and Quality Management.

Dr. Fontane received a Ph.D. in Civil Engineering - Water Resources Planning and Management, Colorado State University, Fort Collins, 1982; a M.S. Civil Engineering -Water Resources Planning and Management, Georgia Institute of Technology, Atlanta, 1970; and a B.S. Civil Engineering, Louisiana State University, Baton Rouge, 1968. He is a registered Professional Engineer and Member of water resources professional societies such as ASCE, AWRA, IWRA. Dr. Fontane has over 95 publications.

#### **Selected Recent Publications:**

- Fontane, D.G., and Frevert, D.K., "Water Management Under Drought Conditions: Overview of Practices", ASCE Journal of Irrigation and Drainage Engineering, Vol 12 1, No. 2, March/April 1995.
- Margeta, J., Ko, S.K., and Fontane, D.G., "Multiple Reservoir System Operational Planning Using Multi-Criterion Decision Analysis", European Journal of Operations Research, Vol. 76, pp.428-439, 1994.
- Mizyed, N.R., Loftis, J.C., and Fontane, D.G., "Operation of Large Multireservoir Systems Using Optimal-Control Theory", ASCE Journal of Water Resources Planning and Management, VOL 1 1 8, No. 4, July/August 1992.
- Ko, S-K, D. Fontane, and J. Labadie. 1992. "Multiobjective Optimization of Reservoir Systems Operation," Water Resources Bulletin, Vol 28, No. 1.
- Gates, T.K., Heyder, W.E., Fontane, D.G., and Salas, J.D., "Multicriterion Strategic Planning for Improved Irrigation Delivery. I & II: Approach & Application", ASCE Journal of Irrigation and Drainage, VOL 117, No. 6, November/December 1991.
- Labadie, J. and D. Fontane. 1989. "Objective Space Dynamic Programming Approach to Multi-Dimensional Problems in Water Resources," in Dynamic Programming for Optimal Water Resources Systems Analysis, A.O. Esogbue (ed.), Prentice Hall, Englewood Cliffs, New Jersey.



## BIOGRAPHICAL SKETCH

**Donald K. Frevert**  
Bureau of Reclamation  
Technical Service Center  
Denver, Colorado

Don Frevert has been a hydraulic engineer with the Bureau of Reclamation's Technical Service Center and predecessor organizations since 1980. His major project responsibilities have included serving as co-principal investigator for the combined USBR-USGS Watershed and River Systems Management Program, serving as principle investigator on Reclamation's Advanced Hydrologic Techniques Research Program, directing a variety of reservoir and river basin management studies throughout the 17 western states, providing technical review on USBR reservoir simulation and optimization methodology and providing technical training for visitors. He is a 2003 recipient of Reclamation's Honor Award for Superior Service.

Don received his Bachelor's Degree in Hydrology from the University of Arizona and holds a Master's Degree in Water Resources and PhD in Irrigation and Drainage from Colorado State University. He presently serves as chair of the Federal Interagency Subcommittee on Hydrology and was technical co-chair of the 2002 Federal Interagency Hydrologic Modeling Conference. Don is an active member of the American Society of Civil Engineers where he was co-chair of the Watershed Management 2000 Conference and recently completed a two year term as chair of the Watershed Management Technical Committee.

## BIOGRAPHICAL INFORMATION

**Terrance J. Fulp, Ph.D.**  
River Operations Manager  
Boulder Canyon Operations Office

### Education

Ph.D. Mathematical and Computer Sciences, Colorado School of Mines, 1996  
M.S. Civil Engineering University of Colorado, 1988  
M.S. Geophysics, Stanford University, 1977  
B.S. Earth Sciences, University of Tulsa, 1975

### Professional Employment

U.S. Bureau of Reclamation, Lower Colorado Region, 2003 to present,  
River Operations Manager, Boulder Canyon Operations Office  
U.S. Bureau of Reclamation, Lower Colorado Region, c/o University of Colorado - CADSWES,  
1989 to 2002, Operations Research Analyst  
University of Colorado - Dept. of Civil, Environmental, and Architectural Engineering, Spring, 1999,  
Instructor  
University of Colorado - CADSWES, 1987-1989, Teaching and Research Assistant,  
Professional Research Assistant  
Atlantic Richfield (Arco) Corporation, 1977-1986, Research and Staff Geophysicist,  
Research Director, Operations Manager

### Relevant Work Experience

- Manager of daily, monthly, and long-term water operations, Hoover to Imperial Dam
- Co-Principal Investigator for the Dept. of Interior's Watershed and River Systems Management Research Program, a joint program with the Bureau of Reclamation and Geological Survey to research and develop decision support systems for watershed and river system management.
- Led technical modeling effort for the Dept. of Interior in the preparation of an environmental impact statement for interim surplus criteria for the Colorado River.
- Led project team in the replacement of the Colorado River Simulation System (CRSS), the Bureau of Reclamation's monthly time-step policy and planning model.
- Coordinated multi-agency effort (Dept. of Interior and Dept. of Energy) in the assessment of the economic benefits of integrated power pooling of hydroelectric resources.

### Selected Publications

Fulp, T., 2003, "Management of Colorado River Resources", Water and Climate in the Western United States, University Press of Colorado, William M. Lewis, Jr. editor  
Zagona, E., and Fulp, T., Shane, R., Magee, T., and Goranflo, H., 2001, " RiverWare: A Generalized Tool for Complex River Basin Modeling", Journal of the American Water Resources Association, Vol. 37, No. 4  
Fulp, T., Vickers, W., Williams, B., and King, D., 1999, "Replacing an Institutional Model: The Colorado River Simulation System Example", Proceedings of the ASCE WaterPower '99 Conference, Las Vegas, NV  
Pulwarty, R., Melis, T., Fulp, T., and Peterson, R., 1998, "Time Scales of Variability in the Colorado River Basin: Implications for the Glen Canyon Adaptive Management Program", paper presented at the 15th

## BIOGRAPHICAL SKETCH

**James (Kip) Gjerde**  
Great Plains Regional Office  
U.S. Bureau of Reclamation

Kip has been with Reclamation since 1981 serving in both technical and management positions in the Regional Office and the Montana Area Office. As a hydraulic engineer in the Planning Division for over 10 years, he conducted and oversaw water supply and water surface profile studies. Kip directed the redesign of GP's HYDROSS water accounting model in the early 1990's to better serve the contemporary needs of the hydraulic engineer/hydrologist. His work in the Area Office involved management and stewardship of project water and related land resources. In his present capacity as Regional Coordinator for the Planning Program and the Title XVI Water Recycling Program, he serves as program and technical representative and has been actively developing guides and standards for each. He is a registered professional civil engineer in Montana and Wyoming. Kip graduated from Montana State University in 1973.

## BIOGRAPHICAL SKETCH

**Neil S. Grigg**  
Professor  
Colorado State University

Neil S. Grigg is Professor and former Head (1991-2000) of the Department of Civil Engineering at Colorado State University. During the past twenty years he has focused on civil infrastructure and water systems and, in particular, on infrastructure management and security; drought and water resources; public works management; utility deregulation; maintenance management systems, finance, law; disaster preparedness; and flood control. He is author of six books, including Water Resources Management, and Water and Sewer Infrastructure Management. His career includes assignments as a civil engineering educator, university administrator, consulting engineer, state government official, and Corps of Engineers officer. He served as Assistant Secretary for Natural Resources and Director of Environmental Management for North Carolina. Since 1988 he has served as River Master of the Pecos River for the U.S. Supreme Court to administer the interstate compact between the states of Texas and New Mexico. In 1968 he was co-founder of Sellards & Grigg Inc, a Denver-area consulting engineering firm. Grigg's degrees are from the US Military Academy, Auburn University, and Colorado State University. He is a registered professional engineer in Colorado, North Carolina, and Alabama. He also has working capability in Spanish, and Portuguese.

## BIOGRAPHICAL SKETCH

**Chris Jansen-Lute**  
Bureau of Reclamation  
Boise, Idaho

Chris is a Natural Resource Specialist and Acting Program Manager for the Water Resources Management Group in the PN Regional office. She has a Bachelors of Science degree in Parks and Recreation Management and Sociology, and a Masters Degree in Natural Resource Management from the University of Idaho.

### **ABSTRACT - ECOLOGICALLY BASED SYSTEM MANAGEMENT PROJECT (EBSM)**

Reclamation, in partnership with the Flathead Lake Biological Station, recently completed the EBSM project (Ecologically Based System Management Project) which identified ecologically based flows on a 71 river-mile reach below Palisades Dam on the South Fork Snake River (Idaho). The goal of EBSM has been to pro-actively manage river resources to address aquatic resource concerns through an ecological approach, avoid future ESA listings, and continue to meet our contractual obligations.

By shaping flows which sustain the river's ecological structure and function, a 'by-species' approach is avoided, and the overall aquatic health of the system is maintained. This approach works within the natural range of hydrologic variability, *while meeting contractual obligations*. The EBSM break out session will provide information on project background, methods, and findings.

## BIOGRAPHICAL SKETCH

**Robert W. Johnson**  
Regional Director  
Lower Colorado Region  
Bureau of Reclamation

Robert W. (Bob) Johnson is the Regional Director of the Bureau of Reclamation's Lower Colorado Region.

Headquartered in Boulder City, Nevada, the Region encompasses southern Nevada, southern California, most of Arizona, and small portions of Utah and New Mexico. The Region's programs include management of the last 700 miles of the Colorado River, extending from Lee's Ferry in northern Arizona to the Mexican border. The Region serves as Water Master of the Lower Colorado River on behalf of the Secretary of the Interior. In addition, the Region provides states, Indian Tribes, and local water resource entities assistance with the planning and development of programs and projects to help meet local water needs. Regional programs are administered by area offices located in Phoenix and Yuma, Arizona; Boulder City, Nevada; at Hoover Dam; and in Temecula, California.

A Reclamation employee since 1975, Johnson has held several managerial positions, including Deputy Regional Director and Chief of the Water, Land and Power Operations Division in the Lower Colorado Region. He also served in a management position in the Office of the Commissioner in Washington D.C. He began his Reclamation career at Reclamation's Mid-Pacific Regional Office in Sacramento, California.

Johnson is a graduate of the University of Nevada-Reno, with a Master of Science degree in agriculture and resource economics.

Johnson a native Nevadan, is married and has two children.

## BIOGRAPHICAL SKETCH

### **Christopher L. Kenney**

Director, Office of Native American Affairs  
Bureau of Reclamation

Chris is a native of Texas with Academic degrees in Political Science, Business and Management, and Economics. In 1982, after 6 years with the U.S. Air Force, he joined the Bureau of Reclamation in the Southwest Regional office in Amarillo, Texas.

In 1985, Chris was transferred to the Office of the Commissioner in Washington D.C. as a Contracts and Repayment Specialist on the Commissioner's Reclamation policy staff.

In 1987, Chris was asked to serve as Special Assistant for Water to the Assistant Secretary for Indian Affairs. In that capacity, he counseled the Assistant Secretary and the Office of the Secretary on water rights and water resource related issues. Also during that time, he represented the Secretary on a number of Indian water rights negotiation teams, primarily in Arizona.

In 1988, Chris assisted the Office of the Secretary with the development of the Departmental Working Group on Indian Water Settlements, and the policies which led to completion of a number of Indian water settlements.

In 1991, Chris returned to the Bureau of Reclamation where he was assigned as Special Assistant to the Assistant Secretary for Water and Science. In 1995, he was appointed Director, Office of Native American Affairs for the Bureau of Reclamation.

## BIOGRAPHICAL SKETCH

**Jeanne Klawon**  
Bureau of Reclamation  
Technical Service Center  
Denver, Colorado

Jeanne Klawon received her Bachelor of Science with Honors in Geology from Bucknell University in 1995. She received her Master of Science in Geosciences from the University of Arizona in 1997. From 1996 to 1999, she worked as a Geologist for the Arizona State Geological Survey on various geologic mapping and water-related projects. In 1999, she began work at the Bureau of Reclamation, conducting applied geomorphology studies related to flood hazards and river management.

### **ABSTRACT - APPLIED FLUVIAL GEOMORPHOLOGY - EXAMPLES OF RECENT STUDIES AT THE BUREAU OF RECLAMATION**

Jeanne E. Klawon, Ralph E. Klinger, Daniel R. Levish, and Robert Hildale, Bureau of Reclamation, Water Resources Division

Fluvial geomorphic studies are being applied to water management problems faced by the Bureau of Reclamation. These studies are diverse in their scope and address issues related to river and sediment management, river rehabilitation, habitat enhancement, and dam safety.

Sediment management studies undertaken in recent years have addressed aggradation along the Little Colorado River in northern Arizona and sediment transport by the Teton River in central Idaho. These studies have included detailed geomorphic mapping to provide constraints on predictive hydraulic models. Stratigraphic studies have been able to estimate stored sediment available for erosion and to provide a chronology of channel changes. Studies of historical behavior and channel change rely heavily on the use of historical aerial photography and geomorphic mapping to characterize the behavior and character of a river prior to human disturbance. Studies of the Gila River in Arizona and New Mexico and rivers in Washington State have provided information regarding fluvial response to the construction of levees, diversion dams, and bridges, and the erosion and aggradation episodes associated with large floods and their impact on fish habitat. The study of the flood history on rivers in the vicinity of Reclamation dams and the establishment of paleohydrologic bounds have been used, particularly in combination with the stream gage records, to more accurately portray flood magnitude at low probabilities. Results of these types of studies have been valuable in making decisions regarding dam safety along the North Platte River in Wyoming.



BIOGRAPHICAL SKETCH  
**DANIEL PETER LOUCKS**

Cornell University

Daniel P. Loucks serves on the faculty of the School of Civil and Environmental Engineering, Cornell University where he teaches and directs research in the application of economic theory and systems analysis methods to the solution of environmental and regional water resources problems. During periods of leave from Cornell, Loucks has held positions at various universities in the US, Europe and Australia, at the World Bank and with various agencies of the United Nations, at the International Institute for Applied Systems Analysis, the US Army Corps of Engineers, the South Florida Water Management District, and with private water management and engineering firms in the US and abroad.

Loucks has served on various committees of the National Research Council of the National Academy of Sciences. He was a member of the US Army Corps of Engineers Environmental Advisory Board from 1994 to 1998, and served as chair of that board from 1996 to 1998. He is an associate editor and as a member of editorial boards of several professional journals in the U.S. and in Europe. He is an Honorary member of the American Society of Civil Engineers and a member of the National Academy of Engineering.

Loucks was commissioned in the U.S. Navy in 1955. He served as an aviator on active duty until 1959 and subsequently in the Naval Reserve until 1981. From 1979 to 1981 he commanded VR-52, the largest Naval Air Transport Squadron in the country having detachments at Naval Air Facility, Detroit, MI, Andrews Air Force Base, MD, and Naval Air Station, Willow Grove, PA.

## BIOGRAPHICAL SKETCH

**Ann Lubas-Williams**  
Special Assistant  
Central Valley Operations Office  
Mid-Pacific Regional Office  
Bureau of Reclamation

Ann Lubas-Williams has worked for the Bureau of Reclamation as a hydrologist and modeler since 1997. In 1999 she went to Central Valley Operations to help with implementation of the CVPIA Section 3406(b)(2) policy. In 2000 prepared a biological assessment for 2-year opinion on two salmonid species, and in 2001 participated in the consultation. Currently responsible for the five species ESA consultation on the Central Valley Project Operations Criteria and Plan (OCAP). The OCAP will have several new projects that are doing their own NEPA and CEQA documents, but OCAP is the federal consultation of the State and Federal combined operations. After the OCAP Biological Opinions, the plan is to review the Coordinated Operations Agreement with the State of California within the Central Valley Operations Office.

During 1997-1999 she was a modeler in the Planning Division, of the Mid-Pacific Region. She ran the PROSIM model and reviewed the CVPIA modeling results. Participated on various groups to provide technical studies, mostly related to the American River and CVPIA Section 3406(b)(2).

From 1986-1995 she worked in the Washington, D.C. area for the Marine Corps as a civilian Operations Research Analyst. She started in the Requirements and Program Division at Headquarters, and then went to the Acquisition Command.

Graduated from the University of Wisconsin, Stout in 1984 with a B.S. in Applied Math. She has completed additional graduate level coursework in Operations Research. Ann resides in Carmichael, California with her husband, Doug, and her daughter, Arwen.

## BIOGRAPHICAL SKETCH

### **Bill Luce**

Area Manager

South-Central California Area Office

Bureau of Reclamation

Bill Luce manages the South-Central California Area Office (SCCAO) in Fresno, where he is responsible for managing and directing a full range of program activities for an area encompassing the San Francisco Bay-Delta, the San Joaquin Valley, and the south coastal areas of Santa Barbara and Ventura Counties. Program activities include a comprehensive operation and maintenance (O&M) program for the Tracy Fish Collection Facility and Friant Dam of the Central Valley Project (CVP) and for Bradbury Dam of the Cachuma Project. His office is also responsible for oversight of contracts for the O&M of 13 other dams, more than 275 miles of canals (ranging in capacity from 1,000-13,000 cubic feet per second), and the water contracts for over 75 water districts and municipalities. His office also performs all resource management activities associated with the responsibilities listed above, oversees drainage-related water quality concerns in the San Joaquin Valley, and manages the implementation of several activities required under the Central Valley Project Improvement Act (Public Law 102-575), including the Land Retirement Program.

Luce began his Reclamation career as a Civil Engineer at the Palmetto Bend Project, Edna, Texas, in 1974 where he performed construction inspection and related activities. From 1977-1981, Luce worked as a Civil Engineer in the Water O&M Branch, Mid-Pacific Regional Office, Sacramento, performing policy oversight activities of regional water storage and conveyance facilities, conducting Review of O&M Exams, and serving as the Safety of Dams coordinator. From 1981-1982, he held the position of Staff Assistant for Engineering in the Office of the Assistant Commissioner, Engineering and Research, duty station Washington, D.C., working on engineering issues and projects including safety of dams and acting as the liaison between the Engineering and Research Center in Denver and the Commissioner's Office. Luce then transferred to Mid-Pacific's Lahontan Basin Projects Office, Carson City, Nevada, where he worked as a Civil Engineer from 1982-1983 performing general engineering activities. He was then promoted to Chief, Water O&M Branch, in the Mid-Pacific Regional Office where, from 1983-1988, he supervised all Branch activities. From 1988-1990, Luce was assigned as the Assistant Project Superintendent in the Fresno Office (CVP) where he assisted the Project Superintendent and was directly responsible for all O&M and contract administration activities. He became head of the office in 1990.

Luce earned Bachelors degrees in Civil Engineering and in Liberal Arts from the University of Delaware in May 1974. He is a Registered Civil Engineer in the State of California.

## BIOGRAPHICAL SKETCH

**J. William (Bill) McDonald**  
Regional Director, Pacific Northwest Region  
U.S. Bureau of Reclamation

Bill began his career in water resources management in 1972 with the Army Corps of Engineers' civil works program. He then spent 14 years with the Colorado Department of Natural Resources, serving 11 years as the Director of the Colorado Water Conservation Board, which is the state's water resources planning and policy agency. During his tenure, he represented Colorado on several interstate organizations and compact commissions, including two years as the chairman of the Western States Water Council.

In 1990, Bill was appointed as the Assistant Commissioner for Resources Management in the Bureau of Reclamation. In that capacity, he was responsible for developing and overseeing the implementation of agency-wide planning, environmental compliance, operation and maintenance, and cost recovery policies and program guidelines.

Between 1994 and 1999, Bill served in other capacities in Reclamation, including as a special assistant to the Commissioner. In 1999, he was appointed the Regional Director for Reclamation's Pacific Northwest Region. The Region encompasses the Columbia River Basin and coastal watersheds in Oregon and Washington.

During the transition from the Clinton to the Bush Administrations, Bill served for six months as the Acting Commissioner of Reclamation.

Bill has an undergraduate degree in chemistry from Colorado College, an M.S. degree in natural resources management from the University of Michigan, and a J.D. degree from the University of Chicago Law School. He was admitted to the Colorado Bar in 1971.

Bill and his wife have eight children, six of whom are adopted and of various racial heritages.

## BIOGRAPHICAL SKETCH

**Brian Person**  
Area Manager  
Eastern Colorado Area Office

Since the fall of 2000, Brian Person has served as the Area Manager for the Eastern Colorado Area Office, part of the Bureau of Reclamation's Great Plains Region. Mr. Person is responsible for managing programs and facilities associated with the Colorado-Big Thompson Project in north-central Colorado, and the Fryingpan-Arkansas Project in south-central Colorado. Both projects collect water from upper west slope tributaries for transport to the arid Front Range and eastern plains for agricultural, municipal, and industrial uses

Prior to beginning his assignment in Colorado, Mr. Person was the Deputy Manager of Resource and Technical Services in Reclamation's Pacific Northwest Regional Office in Boise. Before that, he was Manager of the Yakima Field Office in Yakima, Washington. Earlier assignments include: Oregon Projects Coordinator for the Pacific Northwest Regional Office, stationed in Bend, Oregon; Technical Advisory Team Leader to the Commonwealth Utilities Corporation of the Northern Marianas Islands; Washington Projects Coordinator for the Irrigation Operation and Maintenance Branch at the Pacific Northwest Regional Office in Boise; staff engineer at the Shasta Project Office in northern California, and; staff engineer at the former Missouri-Souris Projects Office (now the Dakotas Area Office) in Bismarck, North Dakota.

Mr. Person is a native of Minot, North Dakota. He has a Bachelor of Science degree in civil engineering from North Dakota State University, and is a Registered Professional Engineer in the state of Idaho.

## BIOGRAPHICAL SKETCH

**Jeffrey D. Rieker**  
Technical Service Center

Employed for four years with River Systems and Meteorology Group of the Technical Service Center, Bureau of Reclamation under the Student Career Experience Program. Graduated from the University of Missouri at Rolla with a B.S. in Civil Engineering, obtained an M.S. in Civil Engineering from Colorado State University, and currently completing Ph.D. coursework in Civil Engineering at Colorado State University.

## BIOGRAPHICAL SKETCH

### **William Rinne**

Deputy Commissioner, Operations  
Bureau of Reclamation

William Rinne is the Deputy Commissioner, Operations of the Bureau of Reclamation. Prior to this he was the Deputy Regional Director of the Lower Colorado Region of the Bureau of Reclamation in Boulder City, Nevada. He also served for five years as the Area Manager of the Boulder Canyon Operations. In that capacity he was responsible for the overall management of the water delivery, river operations, water accounting, water conservation, and water and power contracting programs associated with implementing the Secretary of the Interior's water master functions on the Lower Colorado River. In addition, he has 19 years of experience in several technical, supervisory and managerial positions in the Lower Colorado Region including: Project Biologist, Regional fishery Biologist, Regional Environmental Officer, Regional Liaison in the Washington Office and Director of the Resource Management and Technical Services Office. He has extensive field and management experience on endangered species activities within the Department, Reclamation and in the Lower Colorado Region. He was Reclamation's representative during the initial startup of the Federal/non –Federal Multi-Species Conservation Program and most presently represents Reclamation on several of the Federal activities associated with development and implementation of California's 4.4 Plan. He has a Bachelor of Science in Biology and a Master of Science in Zoology. He and his wife Jan have two grown children and five grandchildren.

## BIOGRAPHICAL SKETCH

**Connie L. Rupp**  
Assistant Regional Director  
Upper Colorado Regional Office  
Salt Lake City, UT

Connie has worked for the Bureau of Reclamation since 1987. In 1991, she decided to attend law school at the University of Utah and obtained a juris doctorate degree in 1994, specializing in natural resources law. She has been working in resource management for the Bureau since that time. She also has training and experience in alternative dispute resolution and mediation. From 1996 to 1998, Connie was the water rights officer in the Sacramento Regional Office. She returned to Utah and the Regional Office in 1998 and worked on water rights and other issues with a primary focus on problems in New Mexico. In 2000, she became the Manager of the Resources Management Division for Upper Colorado Region which includes a staff of program managers, the land resources group, the water resources group, and the program management group. In 2002 she became the Assistant Regional Director and now focuses on responding to hot issues in the Region.



## BIOGRAPHICAL SKETCH

### **Leslie Stillwater**

Planning and Operations Modeler  
Pacific Northwest Region  
Bureau of Reclamation

Leslie Stillwater is a planning and operations modeler for Reclamation's Pacific Northwest Regional Office. She is experienced in applying a variety of simulation, optimization and mathematical programming techniques to modeling regulated river systems. She has been with Reclamation for 12 years, and prior to that was a research fellow at the University of Melbourne, Australia. She has also worked as a hydraulic engineer for Simons Lee and Associates in Fort Collins, Colorado, and as an agricultural engineer contractor for USAID. Leslie has Bachelor's and Master's degrees from Colorado State University in Agricultural Engineering and completed course work towards a Ph.D. in Civil Engineering at the University of Colorado.

## BIOGRAPHICAL SKETCH

**Megan J. Walline, Attorney**  
Solicitor's Office  
Department of the Interior  
Division of Land and Water Resources  
Washington, DC

Megan J. Walline is an attorney with the Division of Land and Water Resources within the Solicitor's Office at the Department of the Interior in Washington, D.C. In that capacity, she specializes in federal Reclamation law, state water law and water rights issues, and Endangered Species Act and Clean Water Act compliance related to Bureau of Reclamation projects, primarily in New Mexico and Oregon.

Ms. Walline earned her J.D. and a certificate in environmental and natural resources law from Northwestern School of Law of Lewis and Clark College and received her undergraduate degree from Cornell University. For three years before law school, Ms. Walline worked on law enforcement and victim assistance issues at the Executive Office for United States Attorneys Department of Justice, in Washington D.C.

## BIOGRAPHICAL SKETCH

### **Robert C. Ward**

Director, Colorado Water Resources Research Institute  
Fort Collins, Colorado

Robert C. Ward is Director of the Colorado Water Resources Research Institute (CWRRI) and Professor of Civil Engineering at Colorado State University (CSU). During 2002-03 he served as President of the National Institutes for Water Resources (NIWR) - the organization that represents the 54 state-based water institutes created and operates under the federal Water Resources Research Act. As director of CWRRI, Robert works with an advisory committee of Colorado water managers to connect the water expertise of Colorado's higher education system with their water research and education needs. CWRRI annually operates a state-based water research competition that funds four to five water research projects. He is the author of two books on water quality monitoring and teaches a graduate level course on the subject. He received his PhD degree from North Carolina State University and has been on the CSU faculty for 33 years. His e-mail address is: [Robert.Ward@ColoState.edu](mailto:Robert.Ward@ColoState.edu).

## BIOGRAPHICAL SKETCH

### **Jim Wilber**

Bureau of Reclamation  
Program Manager  
Albuquerque Area Office

Jim received his undergraduate and graduate degrees in Wildlife Management from the University of Wisconsin - Stevens Point and Texas A&M University, respectively. He is married and raising a 15 year old daughter and 14 year old son. Jim has worked for the Bureau of Reclamation, Albuquerque Area Office since 1991. He started as a fishery biologist and now manages the Middle Rio Grande Endangered Species Act Collaborative Program efforts.

## BIOGRAPHICAL SKETCH

**Bruce E. Williams**  
Hydraulic Engineer  
Boulder Canyon Operations Office  
Lower Colorado Region  
Bureau of Reclamation

Bruce Williams has worked as a Hydraulic Engineer in the Bureau of Reclamation's Boulder Canyon Operations Office in Boulder City, Nevada, since May 1984. The Office is responsible for operations and management of the last 690 miles of the Colorado River from Lee's Ferry in northern Arizona to the Mexican border.

As one of the principal engineers in the Operations Office, Williams is responsible for monitoring annual, monthly, daily and hourly Colorado River operations as they pertain to reservoir releases and contents, energy estimates, facility maintenance schedules, forecasted inflows, consumptive uses, recreation uses, special river events planning and on-going related environmental issues. He also provides assistance to lower basin states, Indian Tribes and local water resource entities with planning and coordinating of water deliveries to help maximize use of river and hydropower resources.

A 26-year federal employee, Williams began his career with the US Geological Survey in Flagstaff, Arizona, in 1977 as a cartographic aide. He began working for Reclamation in the Lower Colorado Region in 1983 as a rotation engineer where he worked in several positions including those with the Central Arizona Project in Phoenix and Western Area Power Administration in Golden, Colorado.

Williams holds a Bachelor of Science degree in Civil Engineering from Northern Arizona University in Flagstaff. He is married and has one child.

## BIOGRAPHICAL SKETCH

**Aaron T. Wolf, Ph.D.**  
Department of Geosciences  
Oregon State University

Aaron Wolf is an associate professor of geography in the Department of Geosciences at Oregon State University. His research focus is on the interaction between water science and water policy, particularly as related to conflict prevention and resolution. He has acted as consultant to the US Department of State, the US Agency for International Development, and the World Bank on various aspects of transboundary water resources and dispute resolution. He is author of *Hydropolitics Along the Jordan River: The Impact of Scarce Water Resources on the Arab-Israeli Conflict*, (United Nations University Press, 1995), and a co-author of *Core and Periphery: A Comprehensive Approach to Middle Eastern Water*, (Oxford University Press, 1997) and *Transboundary Freshwater Dispute Resolution*, (United Nations University Press, 2000). Wolf coordinates the Transboundary Freshwater Dispute Database, an electronic compendium of case studies of water conflicts and conflict resolution, international treaties, national compacts, and indigenous methods of water dispute resolution ([www.transboundarywaters.orst.edu](http://www.transboundarywaters.orst.edu)), and is a co-director of the Universities Partnership on Transboundary Waters.

## BIOGRAPHICAL SKETCH

### **Dick Wolfe, P.E.**

Chief, Water Supply Branch  
Colorado Division of Water Resources  
State of Colorado

Dick was a partner with Spronk Water Engineers for seven years specializing in water resources on various water right issues in Colorado, Kansas, Arizona, and New Mexico. For the past ten years, Dick has been with the Colorado Division of Water Resources and is currently the Chief of the Water Supply Branch for water divisions 2 through 7.

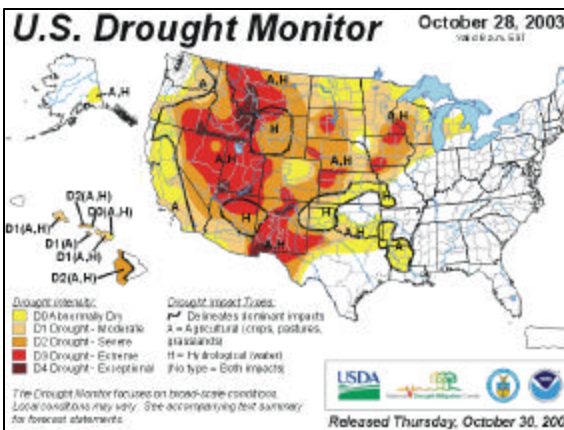
## **Agricultural vs. Urban Uses in Colorado**

As the amount of unappropriated water in Colorado diminishes, the competition for other sources of water for urban uses increases. There are many constraints to developing new water supplies for urban uses including the costs associated with development, legal, institutional and environmental issues. Although demand for ground water has increased, including nonrenewable sources, it is recognized that this is only a component of conjunctive use with surface water supplies. As a result, there is still continued demand for transfer of agricultural water rights to urban uses. In Colorado, the amount of water that can be transferred through water court is based on historical use. Also, a water right is a property right in Colorado that can be sold or traded like any other property right. Although there is an open market of buyers and sellers of water rights in Colorado, conflict is inevitable as these willing buyers and sellers conduct transactions. The transfer of a water right today is more complex since it involves not only technical engineering issues but also political and socio-economic issues regarding basin of origin protection. A few case studies will be examined regarding the conflicts that arise in agricultural to municipal transfers of water rights and what has been done to address these conflicts.

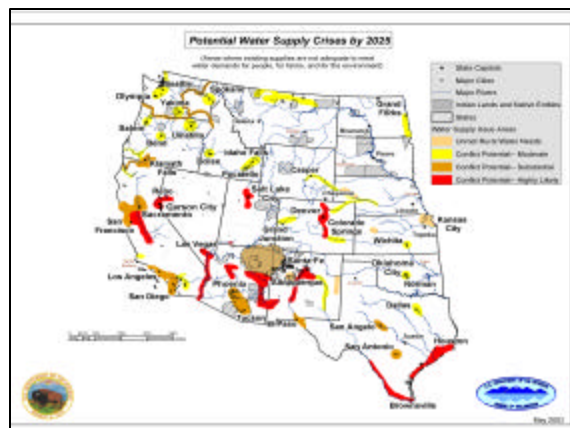


## Reclamation's Mission

- 1) Deliver Water
- 2) Deliver Power
- 3) Do what is Necessary to meet #1 and #2;
- 4) Plan for the Future



## Water 2025: Preventing Crises and Conflict in the West







## Principle One

- Solutions To Complex Water Supply Issues Must Recognize & Respect State And Federal Water Rights, Contracts And Interstate Compacts.



## Principle Two

- Existing Water Supply Infrastructure Must Be Maintained And Modernized So That It Will Continue To Provide Water And Power.



## Principle Three

- Enhance Water Conservation, Use Efficiency, And Resources Monitoring Will Allow Existing Water Supplies To Be Used More Effectively



## Principle Four

- Collaborative Approaches And Market Based Transfers Will Minimize Conflicts Between Demands For Water For People, For Cities, For Farms And For The Environment.



## Principle Five

- Research To Improve Water Treatment Technology, Such As Desalination, Can Help Increase Water Supplies In Critical Areas.



## Principle Six

- Existing Water Supply Infrastructure Can Provide Additional Benefits For Existing And Emerging Needs For Water By Eliminating Institutional Barriers To Storage And Delivery Of Water To Other Uses While Protecting Existing Uses And Stakeholders.



## Reality One:

- Explosive population growth is occurring in arid areas of the West – areas like Phoenix, Las Vegas, Los Angeles, Denver, Salt Lake, Boise, and Albuquerque.



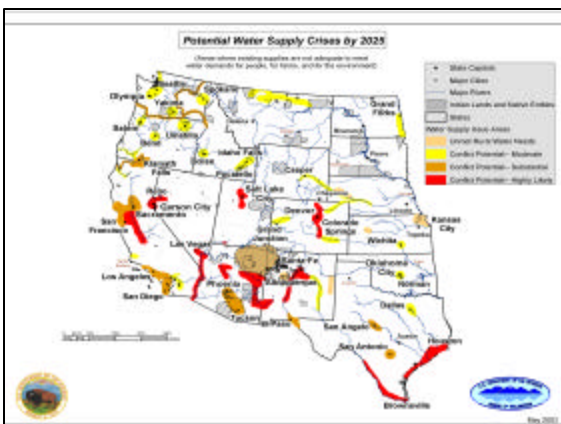
## Demographic Changes: Population Has Grown Fastest in the West, Particularly in the "Public Land States"

Percent Change in Resident Population for the 48 States and the District of Columbia: 1990 to 2000



## Reality Two:

- In some areas, water supplies are or will be inadequate to meet the demands for water for people, for farms, for cities, and for the environment even in normal years



## Reality Three:

- Water shortages can result in bitter conflicts that divide neighbors and put important environmental resources at risk.



#### Reality Four:

- ◆ The existing water supply infrastructure of the West is old.



#### Reality Five:

- ◆ Crisis management is not effective in dealing with water conflicts.



#### Tool #1:

- ◆ Conservation, Efficiency, and Markets



#### Tool #2:

- ◆ Collaboration – Cooperative approaches help to resolve conflict



#### Tool #3:

- ◆ Improved Technology



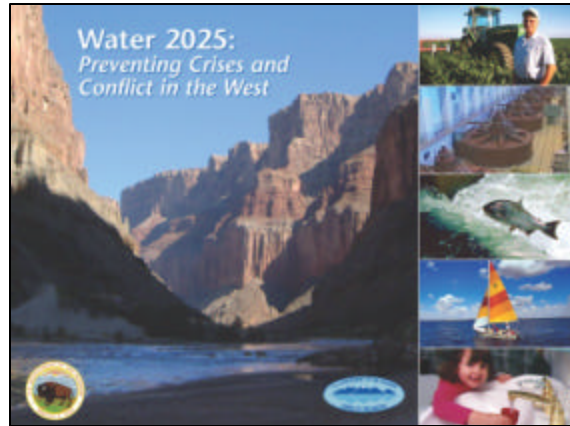


**Tool #4:**

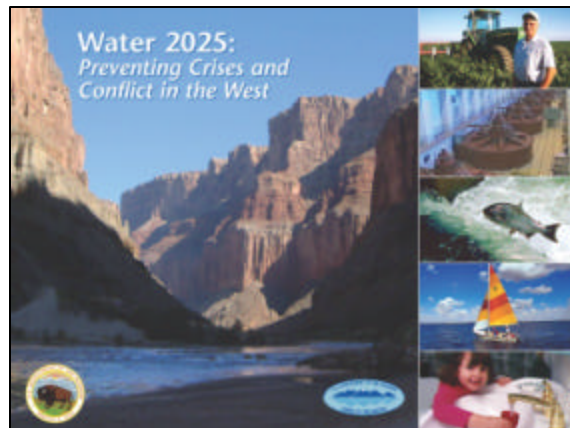
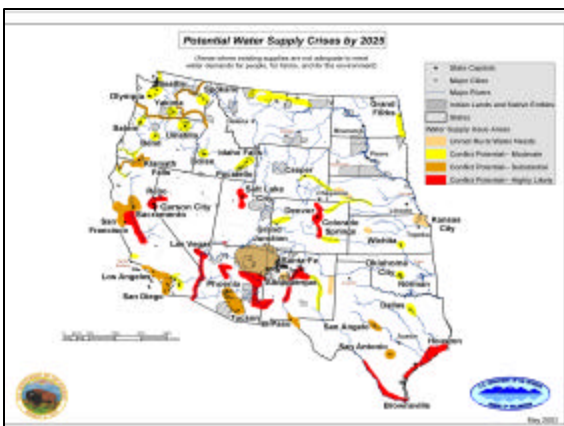
- Remove Institutional Barriers and Increase Interagency Cooperation




**Water 2025:  
Preventing Crises and  
Conflict in the West**





**Water 2025:  
Preventing Crises and  
Conflict in the West**

**Reclamation's Mission**

- 1) Deliver Water
- 2) Deliver Power
- 3) Do what is Necessary to meet #1 and #2;
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For More on Water 2025  
Visit Our Website

[www.usbr.gov](http://www.usbr.gov)



## Biological Assessment and Central Valley Project Operations Criteria and Plan

Bureau of Reclamation  
Department of Water Resources  
November 4, 2003

## ESA Consultation

- Section 7(a)(2) consultation
- Addresses combined major hydrologic operations of the Central Valley Project and State Water Project
- Reclamation lead Federal agency
- Dept. Water Resources lead State agency

## ESA Consultation cont'd

- Reclamation consulting with
  - U.S. Fish and Wildlife
  - NOAA Fisheries
- DWR consulting with
  - Department of Fish and Game

## Reason for Consultation

- CVP/SWP affect listed species
  - Primarily coho salmon, winter-run and spring-run Chinook salmon, steelhead, and delta smelt
- Long-term BOs date from 1993 and 1995
- Short-term BO on spring-run/steelhead
- Update operations to circa 2004
- Long-term BOs need to be concurrent with CVP long-term contracts (2005 – 2030)

## Consultation Documents

- Operations Criteria and Plan
  - Detailed analysis and explanation of criteria and procedures for CVP/SWP operations
- Biological Assessment
  - Identification of proposed actions (continuing operation) of CVP/SWP – present through a future level of development
  - Analysis of effects on listed species of CVP/SWP operations
- Completion of consultation documents targeted for January 2004

## Operations and Criteria Plan

- Detailed project description
- Historic modeling (past to present)
- Forecasting process

## OCAP Biological Assessment

- Description of Action
- Biology of listed species
- Modeling present and future conditions
- Impact analyses
- Ongoing actions to reduce impacts

## Model Assumptions

### Present Conditions

- Trinity River 369 – 453 KAF
- May 2003 (b)(2) Policy
- 2001 level of development
- Current Environmental Water Account

## Model Assumptions

### Future Conditions

- Trinity River 369 – 815 KAF
- Freeport Project
- May 2003 (b)(2) Policy
- South Delta Improvement Program
- 400 cfs Intertie
- CVP/SWP Integration
- 2020 Level of development
- Future EWA

## Schedule

- Draft Project Description – Nov 03
- Effects Analyses – Dec 03
- Initiate Consultation – Jan 04
- B.O.'s by June 30, 2004

## Federal Columbia River Power System BiOp Challenges

2003 River System Management Workshop  
Jim Fodrea, PN Region  
Columbia/Snake Salmon Recovery Office

## FCRPS BiOp Challenges

- BiOp implementation
  - Hydro operations
  - Off-site mitigation and RM&E
  - Coordination
- Legal
- Policy

## FCRPS Background

- Fourteen major federal dams and reservoirs
  - 5 major storage dams (16 maf) including Grand Coulee (5 maf) and Hungry Horse (3 maf)
  - 9 lower Snake and Columbia mainstem dams (Corps)
- FCRPS coordinated with numerous non-Federal projects including 3 (20 maf) in Canada



## Endangered Species

- 12 ESUs of Columbia and Snake River Salmon
- Kootenai River sturgeon
- Bull trout

## FCRPS BiOps

- 2000 BiOps issued by NOAA Fisheries and USFWS
- latest in series of consultation (1992, 1993, 1994, 1995, 1998, 2000)
- NOAA -- FCRPS jeopardizes 8 of 12 ESUs
- USFWS -- FCRPS jeopardizes sturgeon, not bull trout



## FCRPS impacts to salmon

- Storage operations reduce flows for juvenile fish migration in spring
- Run-of-river reservoirs reduce flow velocities for juvenile fish and slow their spring and summer migration
- Reservoirs increase exposure to predation and higher temperatures
- Dams create passage problems
- Spill at dams increases dissolved gas levels

## NOAA FCRPS BiOp

- 199 actions in the RPA
- Hydro operations -- flows, spills for passage
- Hydro configuration
- Juvenile fish transportation
- Off-site mitigation
- Research, monitoring, and evaluation
- Planning and reporting
- Coordination

## BiOp Hydro operations

- Spring flow augmentation
  - reduced power drafts at Grand Coulee and Hungry Horse
  - reduced flood control requirements at Hungry Horse (VARQ)
- Summer flow augmentation
  - Grand Coulee, Hungry Horse, and Banks Lake drafts
  - Upper Snake – up to 427 kaf as off-site mitigation for FCRPS

## Off-site mitigation

- BiOp conclusion
  - hydro system cannot be reconfigured or operated differently enough to avoid jeopardy
  - Action agencies must make up “jeopardy gap” through habitat, hatchery, and harvest actions
- Reclamation program
  - address tributary screen, barrier, and flow issues in 15 major subbasins
  - pursue needed construction authority (S. 1307)

## Coordination

- Action Agencies -- USBR, Corps, BPA
- NOAA Fisheries Regional Forum
- Northwest Power and Conservation Council
- NW states and tribes
- Federal Caucus

## Legal

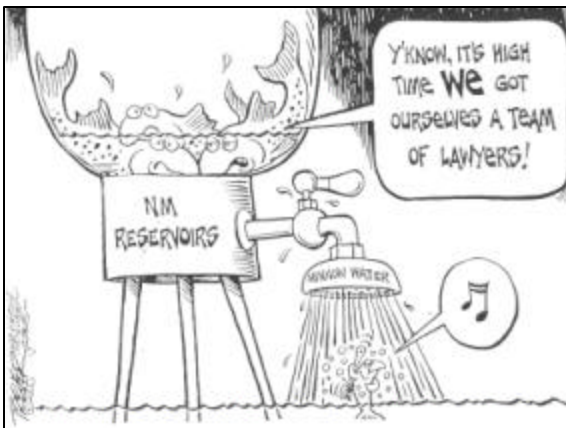
- National Wildlife Federation v. NOAA
  - Ruling for plaintiffs put BiOp in remand
  - RPA relied too much on actions that were not reasonably certain to occur
  - Remainder of BiOp stays in place
- Columbia/Snake and E. Oregon irrigators v. NOAA
  - BiOp goes too far
- 60-day notice NWF to NOAA and USBR on Snake River Projects
  - relied on FCRPS BiOp
  - Reclamation and NOAA need to incorporate into FCRPS consultation

## Policy issues/decisions

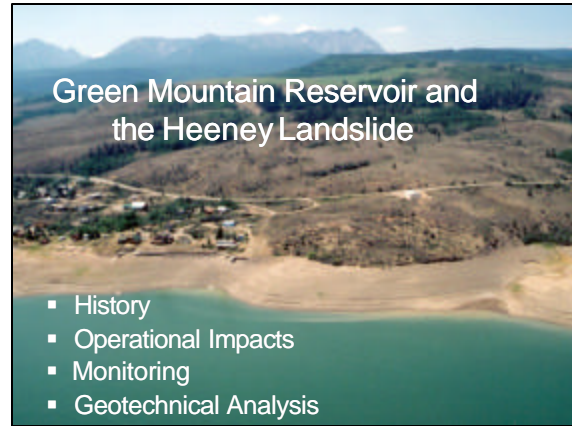
- Revise the FCRPS jeopardy standard and analysis?
- Emerging science
- Improving run status
- Move to less prescriptive RPA?
- Revise the NOAA BiOp in remand or re-initiate consultation?
- November 4, 2004 – D.C. Salmon Policy Team meeting at CEQ



Rio Grande Restoration  
 University of New Mexico  
 Fish & Wildlife Service  
 Alliance for Rio Grande Heritage  
 Bureau of Reclamation  
 Pueblo of Isleta  
**Federal, State, Local, and  
Private Stakeholders**  
 National Association of Industrial and Office Properties  
 Middle Rio Grande Conservancy District  
 New Mexico State University  
 Forest Service  
 City of Albuquerque  
 Corps of Engineers  
 State of New Mexico  
 Bureau of Indian Affairs





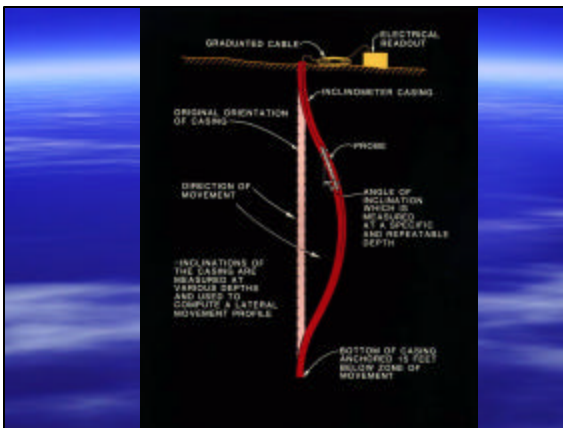
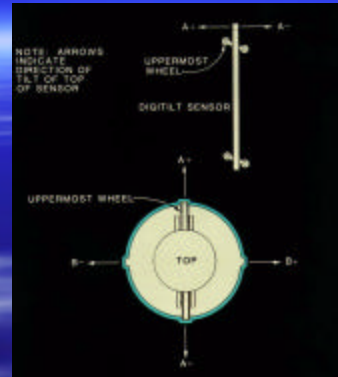






## Inclinometers

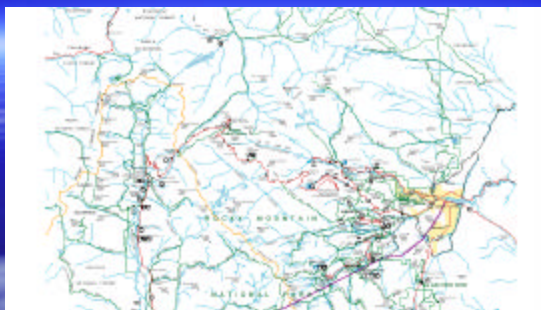
- Description
- Function



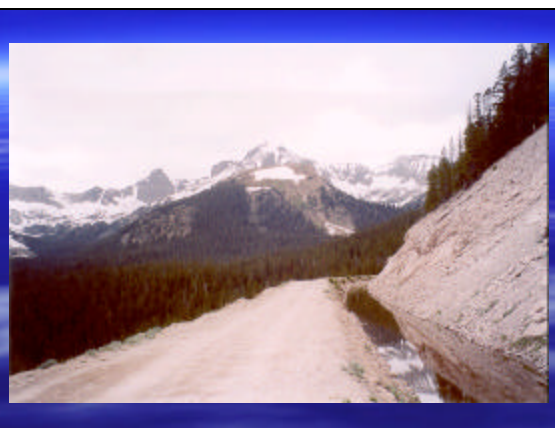
## Operating Limitations

- Previous
  - Drawdown Rates
    - No Greater Than 1.5 Ft./Day Below WSE 7880
    - No Greater Than 1.0 Ft. Day Below WSE 7870
  - Minimum Water Surface Elevation 7850
- New
  - Drawdown Rates
    - No Greater Than 1.5 Ft./Day Below WSE 7880
    - No Greater Than 1.0 Ft./Day Below WSE 7870
    - No Greater Than 0.5 Ft./Day Below WSE 7865
  - No Minimum Water Surface Elevation
  - Ongoing Data Assessment and Observations





Rocky Mountain National Park

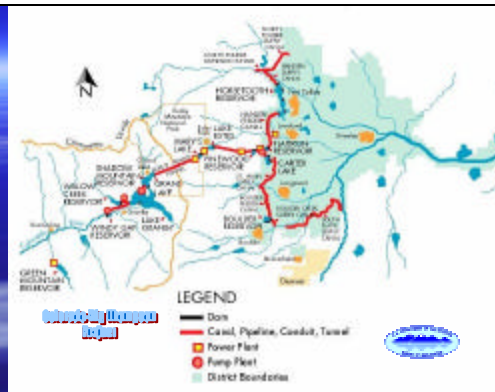






## Water Supply and Storage Company

- Located East of Fort Collins, Colorado
- 50,000 Total Irrigable Acres
- Average Annual Water Supply: 61,000 acre-feet; 18,000 of which is from Grand Ditch
- Primary Crops Include: Beans, Alfalfa, Onions, Corn, Sugar Beets, Malt Barley



## Reclamation States Emergency Drought Relief Act of 1991

### SEC. 102. AVAILABILITY OF WATER ON A TEMPORARY BASIS.

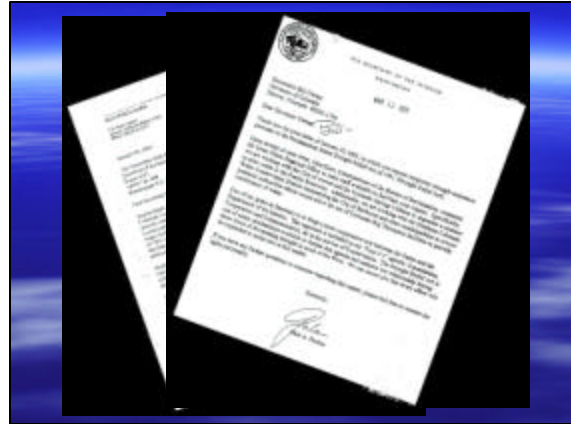
(a) GENERAL AUTHORITY. In order to mitigate losses and damages resulting from drought conditions, the Secretary may make available, by temporary contract, project and nonproject water, and may permit the use of facilities at Federal Reclamation projects for the storage or conveyance of project or non-project water, for use both within and outside an authorized project service area. *(emphasis added)*

(b) Special Provisions Applicable to Temporary Water Supplies Provided Under This Section-

(1) TEMPORARY SUPPLIES. Each temporary contract for the supply of water entered into pursuant to this section shall terminate no later than one year after the date of enactment of this Act, or the termination of the temporary drought program described in section 105, whichever comes first.

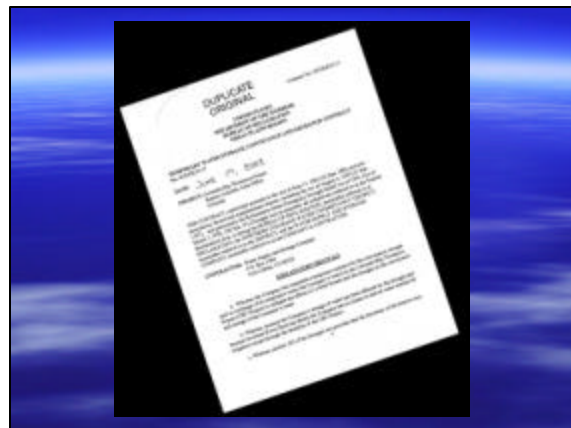
(2) OWNERSHIP AND ACREAGE LIMITATIONS. Lands not subject to Reclamation law that receive temporary irrigation water supplies under temporary contracts under this section shall not become subject to the ownership and acreage limitations or pricing provisions of Federal Reclamation law because of the delivery of such temporary water supplies. Lands that are subject to the ownership and acreage limitations of Federal Reclamation law shall not be exempted from those limitations because of the delivery of such temporary water supplies.

(3) TREATMENT UNDER RECLAMATION REFORM ACT OF 1982. No temporary contract entered into by the Secretary under this section shall be treated as a 'contract' as that term is used in sections 203(a) and 220 of the Reclamation Reform Act of 1982 (Public Law 97-293).



## Cooperating Entities

- Water Supply and Storage Company
- Northern Colorado Water Conservancy District
- Middle Park Water Conservancy District
- Colorado River Water Conservation District
- Colorado Department of Natural Resources
- Fish and Wildlife Service
- National Park Service



Questions?

Thank You



**D-8230**  
**Water Treatment**  
**Engineering & Research**  
**Group**

Technical Service Center  
 Denver, CO

## Capabilities

- The Water Treatment Engineering & Research (WaTER) Group (D-8230) provides expert water and wastewater treatment engineering and research technical services to our customers. The WaTER Group consists of professional engineers, chemists, scientists, and technicians.

## Engineering services:

- Needs assessments
- Appraisal and feasibility level studies
- Final design and construction packages
- Potable water treatment systems for surface and groundwater sources using conventional or advanced water treatment systems,
- Treatment for brackish or seawater sources using desalination
- Conventional and Advanced wastewater treatment
- Water reuse and recycling systems
- Remediation of hazardous chemicals
- Training and educational workshops


## Research services:

- Laboratory, bench-scale, pilot-scale, and demonstration testing
- Desalination and Water Purification Research and Development (DWPR) Program - Applied R&D directed toward reducing the cost of desalting to increase municipal, industrial, agricultural, and recreational water supplies in the U.S.
- Advanced Water Treatment Research (AWTR) Program - Investigation and development of technologies to improve Reclamation projects and programs
- Water Reclamation and Reuse (Title XVI) Studies and Projects - Investigate and identify opportunities for water reclamation and reuse
- Research studies in chemical processes
- Evaluation of innovative technologies

## Water Reuse

### Payson, AZ



Ultrafiltration to remove  
 Turbidity, Manganese,  
 Bacteria, & Spores

## Featuring

### vacuum driven

### UF -

The ZeeWeed® Hollow Fiber Membrane

The ZeeWeed® membranes are immersed in the process tanks

### Objectives:

- Reduce Turbidity from 10 NTU to <1
- TSS from ~ 45 mg/L
- HPC from 350 cfu/100 mL to much less
- E. Coli from Positive to Negative
- TTHMP from 350 ppb to <80

### Results:

- Turbidity <0.1 NTU
- TSS <1 mg/L
- E.Coli Negative
- TTHMP – No Change
- Fe reduced from 0.2 to 0.05 mg/L
- Mn reduced from 0.04 to <0.02 mg/L

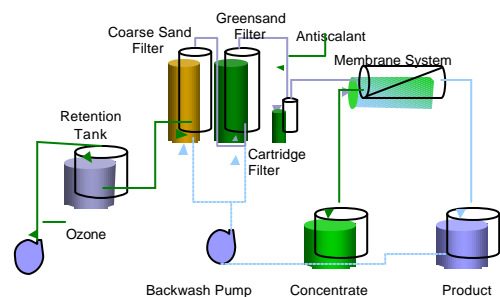
### Sulfate, Iron, & Manganese – Virgin River in Mesquite, NV

#### Process Steps

Raney Collector  
Ozonation  
Sand Filtration  
Greensand Filtration  
Antiscalant  
Nanofiltration or  
Reverse Osmosis



### Process Diagram



### Objective: Drinking water from the Virgin River

- Reduce TDS from 3900 mg/L to 300 mg/L
- Reduce Iron from 3.8 mg/L to 0.6 mg/L
- Reduce Manganese from 1 mg/L to 0.1 mg/L
- 75% recovery
- Validate blending of feed water with RO permeate -or-
- Straight NF

### Results:

- | Nanofiltration  | Reverse Osmosis          |
|-----------------|--------------------------|
| ■ TDS ~170      | ■ TDS ~ 40               |
| ■ Iron ~ 0      | ■ Iron ~ 0               |
| ■ Manganese ~ 0 | ■ Manganese ~ 0          |
| ■ Recovery 50%  | ■ Recovery – in progress |

## Mobile Water Treatment Pilot Plant (MTP)



## Recognizing a Need:

- Many communities rely on water supplies with high TDS, contaminants
- Supplies pose health risks, do not comply with SDWA
- MTP provides technical assistance to small, Native American communities, etc.
- Determines optimum water treatment process which achieves desired water quality
- 50-50 cost share basis

## MTP Capabilities:

- Both conventional & advanced water treatment processes
- Easily transported
- Flexibility in system configurations
- External pumping & storage capacity
- Compliance with OSHA & DOT regulations
- Electrical power generator for remote sites
- Water treatment capacity ranging from 4 to 6 GPM

## MTP Unit Processes:

### Physical Operations

- Rapid mix
- Flocculation
- Sedimentation
- Cyclone separator
- Filtration (gravity/pressure, cartridge, slow sand, dual media)

### Chemical Processes

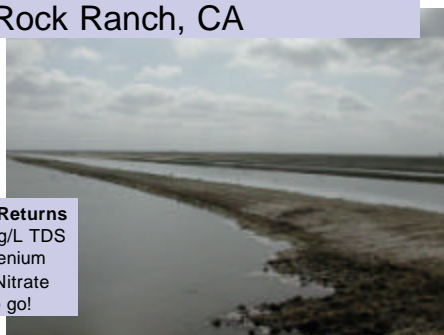
- Oxidation
- Precipitation
- Activated carbon
- Ion exchange
- Disinfection (chlorine, ozone, UV)

### Membrane Processes

- RO - UF - NF - ED/EDR - MF

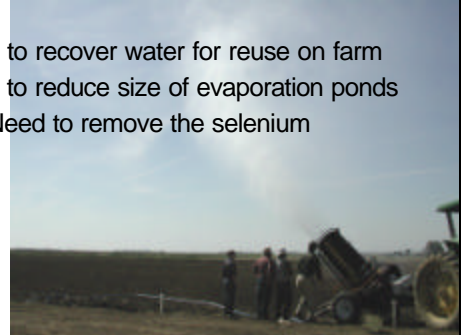
## Selenium & Salt – Red Rock Ranch, CA

**Irrigation Returns**  
~15,000 mg/L TDS  
1 mg/L Selenium  
400 mg/L Nitrate  
Nowhere to go!



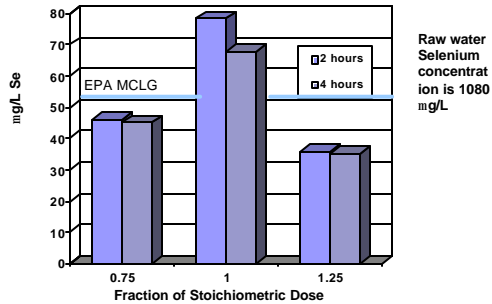
## Two Problems for One

- Need to recover water for reuse on farm
- Need to reduce size of evaporation ponds
- -or- Need to remove the selenium

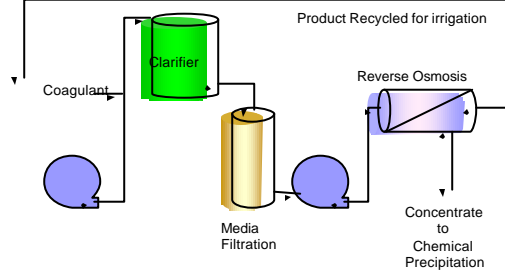




## Precipitation with Ferrous Sulfate



## Reverse Osmosis w/ Concentrate Precipitation



## Concentrate Minimization – Phoenix, AZ

Featuring the US Army's Tactical Water Purification System



- Concentrate will be further reduced in volume using Dewvaporation.
- Dewvaporation is a desalination humidification/dehumidification process that uses air as a carrier gas to evaporate water from saline feeds and form pure condensate at constant atmospheric pressure.



8 GPD Tower



50-200 GPD Tower

## Project Goals:

- Treat secondary WW effluent using MF/RO
- RO effluent at 5,000 mg/L TDS
- MF/RO concentrate to 10,000 GPD Dewvap to achieve higher recoveries
- Left with pure condensate -and-
- A slurry of salt at 200,000 mg/L TDS (98% recovery)
- \$3.50/1,000 gal using natural gas as heat source

## Kickapoo Tribe of Kansas – Water Treatment Plant Assessment



## Background:

At the request of the Kickapoo Tribe in Kansas (Tribe) an assessment of their existing small community surface water treatment plant (WTP) was conducted on March 29, 2001.

The inspection was performed for the purposes of determining system capacity and providing recommendations for improved operation and maintenance (O&M).

## Need for Assessment:

The Kickapoo Reservation is located in Brown County, KS about 5 miles west of Horton, KS.

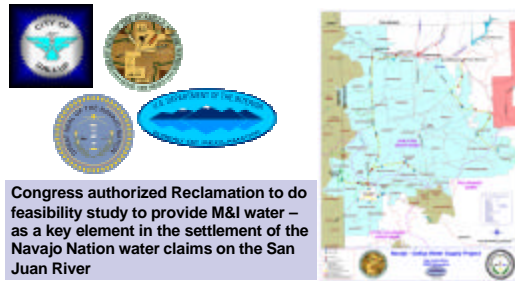
The Tribe's surface water supply is the Delaware River. The Tribe is historically plagued by drought-conditions and maximum, efficient operation of the conventional WTP is crucial.

## Findings/Recommendations:

- Limiting unit process – operation of one raw water pump
- Improved record keeping and O&M
- Installation of emergency generator to minimize downtime due to lightening strikes
- Replacement of several pieces of problem equipment



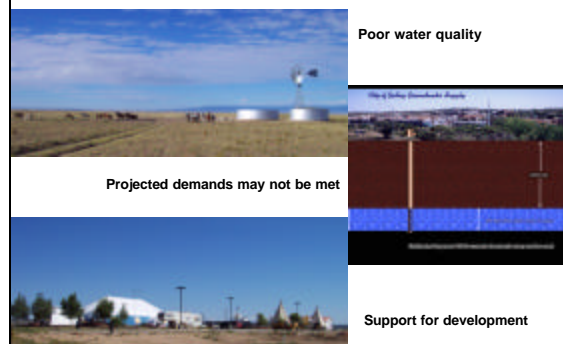
## Navajo Gallup Water Supply Project



Typical Navajo household has no water – must truck water in



## Problems to address...




### Schedule:

- 2003 – Planning
- 2004 – EIS
- 2005 – Authorization
- 2006 – 2011 – Construction
- 2010 – Project provides water!









## California's “4.4 Plan”

Robert F. Snow  
Office of the Solicitor




2003 BOR River Systems Management Workshop 1




## Overview

- ❖ The Problem: California
- ❖ Legal Setting: “*Law of the River*”
- ❖ The California Plan: Original Concept
- ❖ Stumbling Blocks
- ❖ How the Deal was resolved
- ❖ “Lessons Learned”



2003 BOR River Systems Management Workshop 2



## Legal Setting: “*Law of the River*”

- ❖ The Problem: California
  - ❖ Application of Prior Appropriation Doctrine on Interstate River
- ❖ 1922 Compact: allocates 7.5 maf to Upper & Lower Basins in perpetuity




2003 BOR River Systems Management Workshop 3



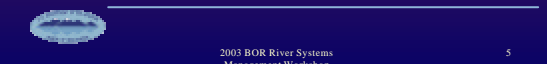


2003 BOR River Systems Management Workshop 4



## Legal Setting: “*Law of the River*”

- ❖ 1928 Boulder Canyon Project Act
  - ❖ Ratified 1922 Compact
  - ❖ Authorized Construction of Hoover Dam
  - ❖ Conditioned on California limiting its allocation to maximum of 4.4 MAF
  - ❖ Interpreted in *Arizona v. California*



2003 BOR River Systems Management Workshop 5



## Legal Setting: “*Law of the River*”

- ❖ *Arizona v. California*: Decision ('63) & Decree ('64)
  - ❖ Upheld Congressional Apportionment of BCPA
  - ❖ Confirmed Secretary's Authority on lower Colorado
  - ❖ “Federalized” river
  - ❖ Mandatory permanent injunction

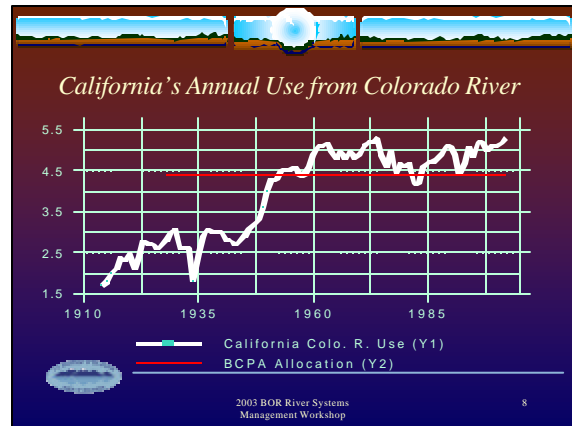


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### Legal Setting: "Law of the River"

- ❖ 1968 Colorado River Basin Project Act
  - ❖ Authorized Central Arizona Project
  - ❖ Designated Arizona as junior user
  - ❖ Provides for equalization betw. Powell/Mead

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### Concern of Basin States

- ❖ Modify Compact apportionments
- ❖ Actions that jeopardize permanent allocations
- ❖ Equalization of Powell/Mead

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### California Plan: Original Concepts

- ❖ Transfers from IID to San Diego
- ❖ ESA Sec. 10 HCPs

2003 BOR River Systems Management Workshop 10

### California Plan: Stumbling Blocks

- ❖ Water
- ❖ Money
- ❖ Control
- ❖ Legal Authority
- ❖ Regulatory/Statutory certainty ...
- ❖ OFF RAMPS! (lots of 'em)

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### California Plan: The Task

- ❖ Limit reach of Federal Agreement to appropriate issues & eliminate linkage to other docs
- ❖ Allow agreement among parties on financial issues, etc...
- ❖ Get concurrence of 6 Basin States
- ❖ Certainty of reductions
- ❖ IN TEN PAGES!

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### *Cal. 4.4 Plan: How the Deal was Resolved*

- ❖ NO OFF RAMPS! (i.e., none!)
- ❖ Transfers: Benefits/Consequences
- ❖ Beneficial Use Assurances & Litigation dismissed
- ❖ “70R” Agreement post-2015
- ❖ Salton Sea: State responsibility
- ❖ Interim Surplus Guidelines reinstated



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Management Workshop

13



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14

### Summary

- ❖ Decree in *Arizona v. California* enforced
- ❖ BOR implemented a beneficial use decision
- ❖ Federal decisionmaking limited to appropriate scope of issues



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Management Workshop

15

### Where to Get More Information

- ❖ [www.usbr.gov/lc](http://www.usbr.gov/lc)
- ❖ “Ten Pager”
- ❖ Record of Decision
- ❖ Secretary’s Addresses to Colorado River Water Users Association (1993-2002)



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Management Workshop

16

# PRACTICUM IN WATER CONFLICT RESOLUTION: LESSONS FROM AROUND THE WORLD

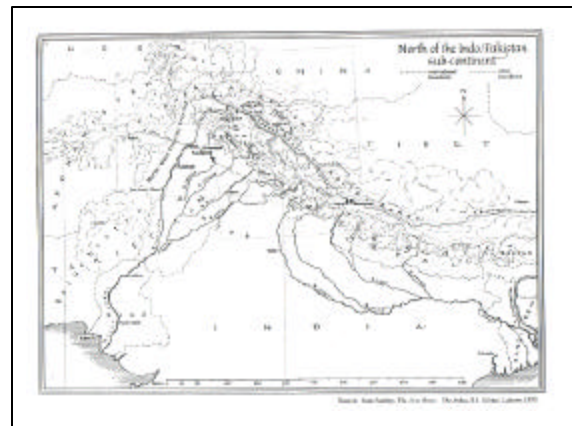
Aaron T. Wolf, Ph.D.  
Department of Geosciences  
Oregon State University, USA

104 Wilkinson Hall  
Corvallis, OR 97331, USA  
Tel: +1-541-737-2722  
Fax: +1-541-737-1201  
Email: wolfa@geo.orst.edu  
Website: www.transboundarywaters.orst.edu



## Partnership Objectives

- Enhance capacity to address and prevent transboundary waters conflict and degradation
- Four focus area initiatives
  - Training workshops
  - Graduate and professional certification
  - Linked information technology
  - Collaborative analytical studies

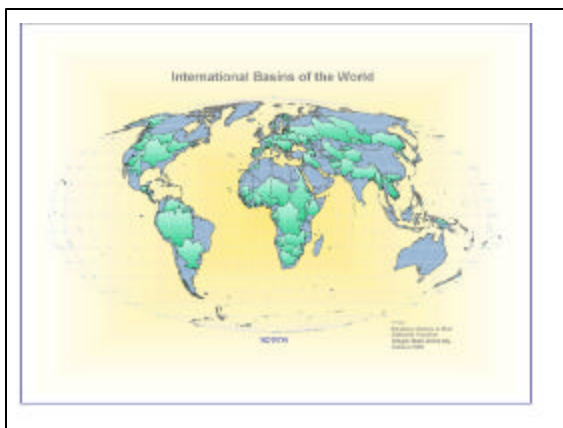




## Water and Conflict

“Fierce competition for fresh water may well become a source of conflict and wars in the future.”

- Kofi Annan, March 2001



## The Transboundary Freshwater Dispute Database

A Project of  
Oregon State University  
Department of Geosciences  
and the Northwest Alliance for  
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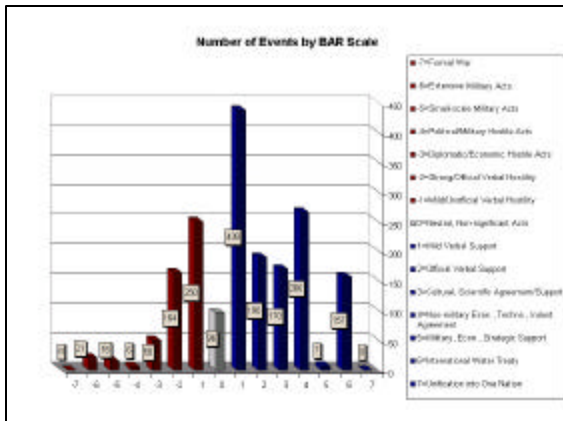
- Reference to 3,600 water-related treaties (805-1997)
- Full-text of 400 treaties and 40 US compacts, entered in computer database
- Detailed negotiating notes (primary or secondary) from fourteen case-studies of water conflict resolution
- Annotated bibliography of “State of the Art” of water dispute resolution literature
- News files on cases of acute water-related disputes
- Indigenous methods of water dispute resolution

### Interactive Search Interface

[www.transboundarywaters.orst.edu](http://www.transboundarywaters.orst.edu)

DATE	BASIN	COUNTRIES	BAR SCALE	EVENT SUMMARY	ISSUE TYPE
10/3/73	La Plata	Argentina-Paraguay	4	FRY AND ARG AGREE TO BUILD IB DAM. HYDROELECTRIC PROJECT	Infrastructure
1/1/76	Ganges	Bangladesh-India-United Nations	-2	Bangladesh lodges a formal protest against India with the United Nations, which adopts a consensus statement encouraging the parties to meet urgently to settle the level of minister, to arrive at a settlement.	Quantity
7/3/78	Amazon	Bolivia-Brazil-Colombia-Ecuador-Guyana-Peru-Suriname-Venezuela	6	Treaty for Amazonian Cooperation	Economic Development
4/7/95	Jordan	Israel-Jordan	4	Pipeline from Israel storage at Beit Zera to Abdullah Canal (East Ghor Canal) begins delivering water stipulated in Treaty (20 MCM summer, 10 MCM winter). The 10 mcm replaces the 10 mcm of desalinated water stipulated Annex I, Article 2d until desalination plant completed	Quantity
6/1/99	Senegal	Mali-Mauritania	-3	18 people died in communal clashes in 6/99 along border between Maur. & Mali; conflict started when herdsmen in Mousa-Samoua village in w. Mali, refused to allow Maur. horsemen to use watering hole; horsemen returned w/ some of this classmen, attacking village on 6/20/99, causing 2 deaths; in retaliation that followed, 11 more died.	Quantity

**Events Database, Example**



## Institutional Resiliency Argument

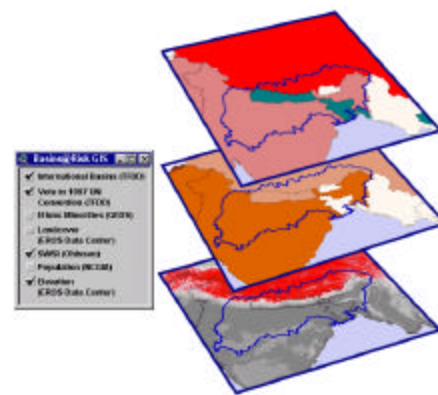
**Transboundary water institutions are resilient over time, even between hostile riparians, even as conflict is waged over other issues:**

- Picnic Table Talks
- Mekong Committee
- Indus River Commission
- Caucasus
- SADC Region

## Water Myths and Water Facts

### Causes of conflict include:

- Climate
- Water stress
- Population
- Level of development
- Dependence on hydropower
- Dams or development *per se*
- “Creeping” changes:
  - general degradation of quality
  - climate change induced hydrologic variability



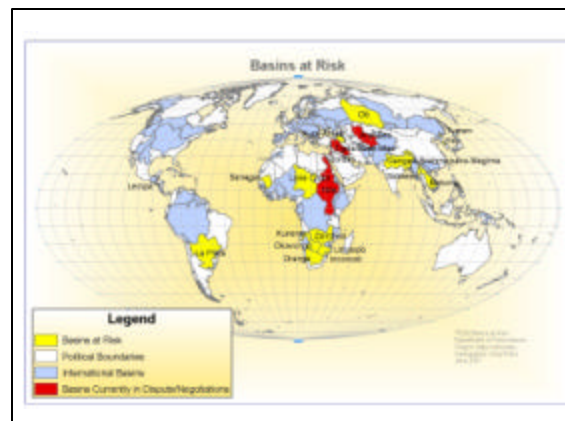
## BASINS AT RISK: Working Hypothesis

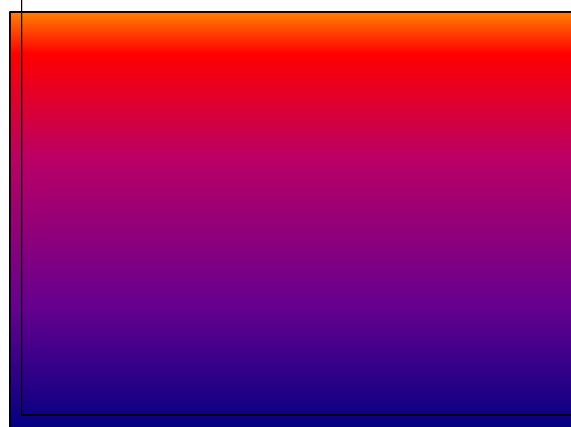
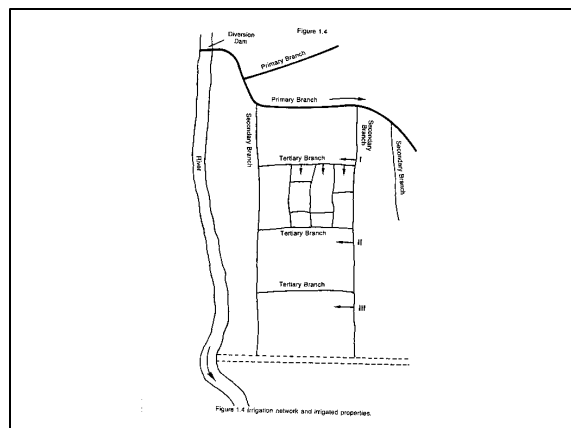
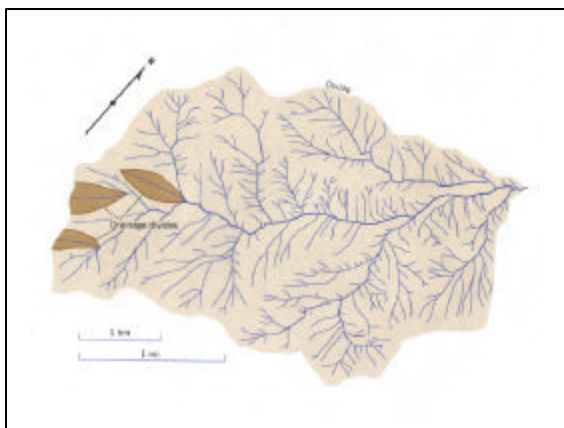
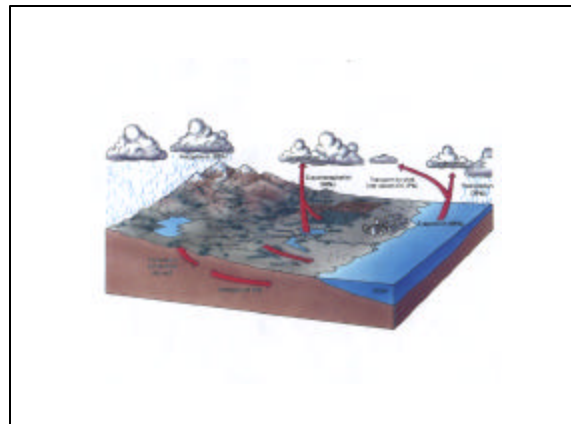
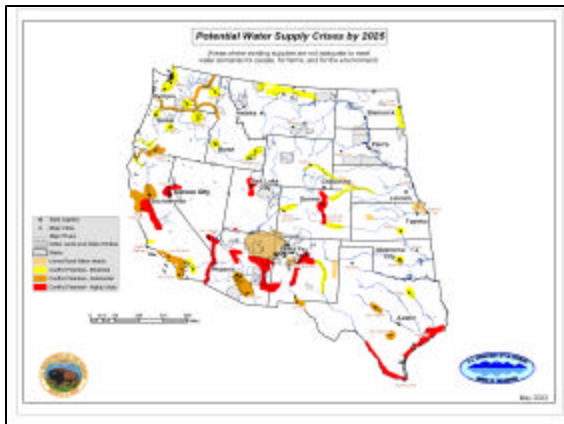
*“The likelihood of conflict rises as the rate of change within the basin exceeds the institutional capacity to absorb that change.”*

## What *are* indicators?

Sudden physical changes or lower institutional capacity are more conducive to disputes:

- 1) Uncoordinated development: a major project *in the absence* of a treaty or commission
- 2) "Internationalized basins"
- 3) General animosity

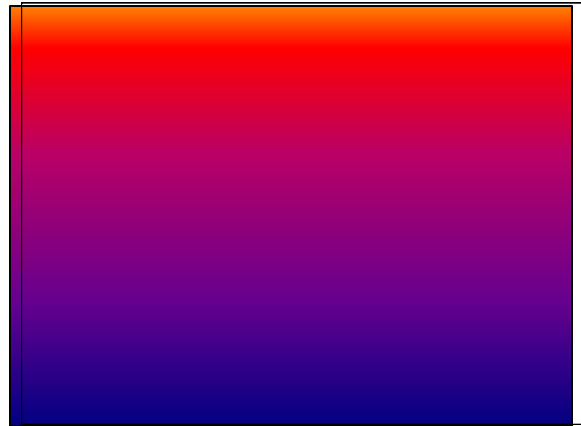






# INDIGENOUS METHODS OF WATER DISPUTE RESOLUTION: The Berbers of the High Atlas Mountains and the Bedouin of the Negev Desert

- 1) **ALLOCATE TIME, NOT WATER**
  - Allocates fluctuations to local management
  - Allows for markets without structures
- 2) **PRIORITIZE USE**
  - Allows for management of fluctuation
  - Protects infrastructure (prior uses)
- 3) **PROTECT DOWNSTREAM RIGHTS**
  - Relies on traditional diversions and agreements
- 4) **"ALTERNATIVE DISPUTE RESOLUTION"**
  - Clearly defined water authority
  - "Shared vision"
  - Threat of "BATNA" -- zero-sum vs. positive sum solutions
- 5) **"SULKHA"** -- A ceremony of forgiveness



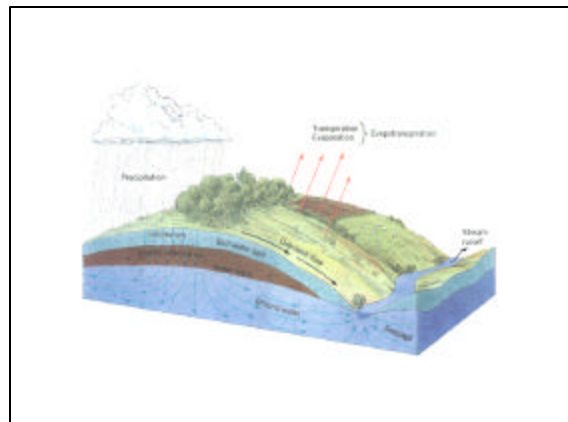
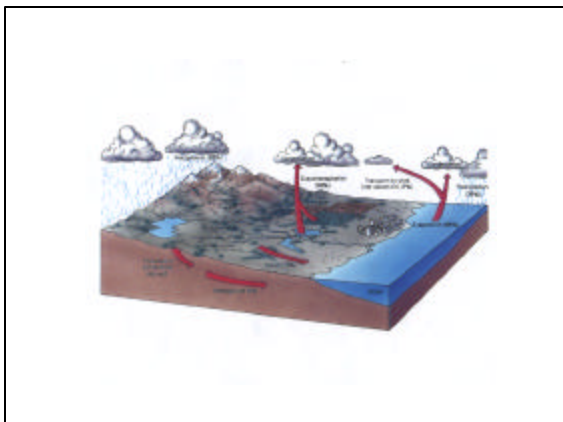
## PRACTICUM IN WATER CONFLICT RESOLUTION: LESSONS FROM AROUND THE WORLD

Aaron T. Wolf, Ph.D.  
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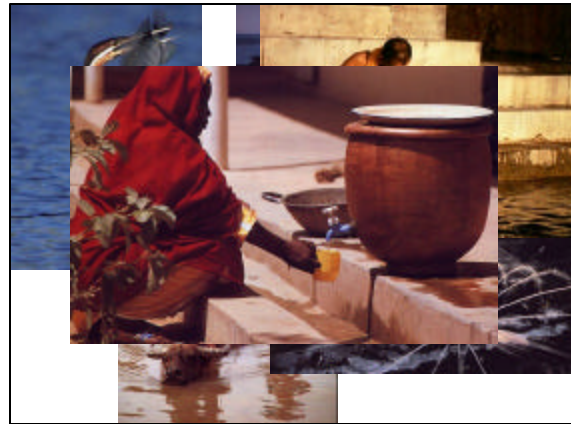
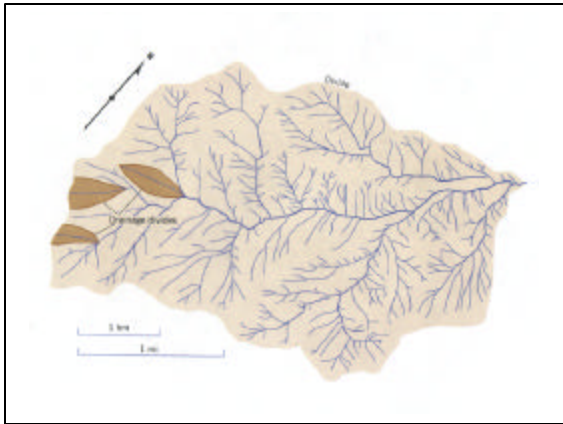
104 Wilkinson Hall  
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Fax: +1-541-737-1201  
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Website: www.transboundarywaters.orst.edu

## Global Water Crisis

- Almost 3 billion people lack access to adequate sanitation
- >1 billion people lack access to safe drinking water
- At least 250 million illnesses result
- 5-10 million deaths
- 20% of irrigated lands are salt-laden
- Water-related disease costs US\$125 billion/yr.
- Would "only" cost US\$7-50 billion/yr. to resolve





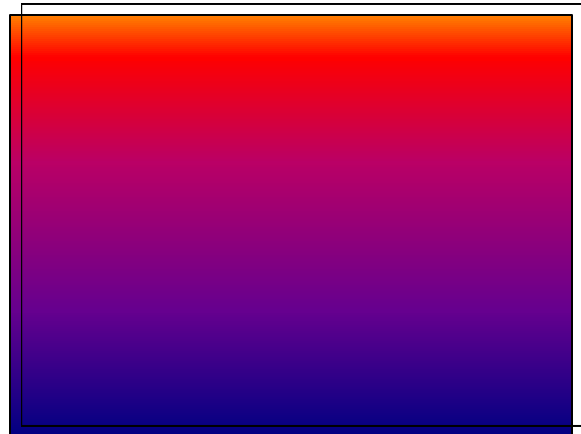


## HOW SALIENT IS WATER AS AN ISSUE OF CONFLICT?

Maslow (1954) categorizes and ranks basic human needs to their level of motivating behavior.

From inner to outer, these are:

- physiological needs,
- safety needs,
- belongingness and love,
- esteem, and
- self-actualization.



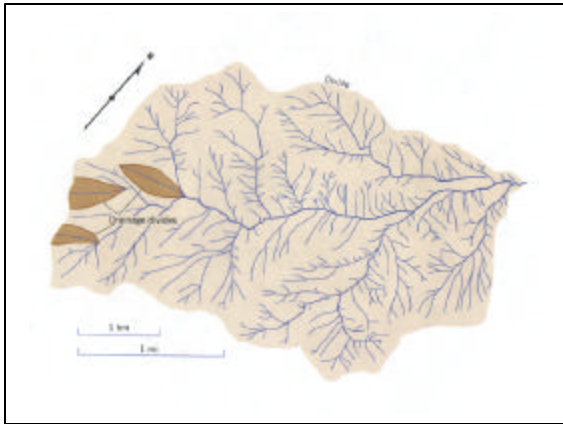
## ALLOCATING A SCARCE RESOURCE

- 1) Provide for those with the greatest need.
- 2) Provide for those with the greatest chance of success.
- 3) Provide for those with the best history of use.
- 4) Provide for those with the ability to pay.
- 5) Provide by lottery.

## ALLOCATING A SCARCE RESOURCE

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American Medical Association  
Conference on Organ Transplants



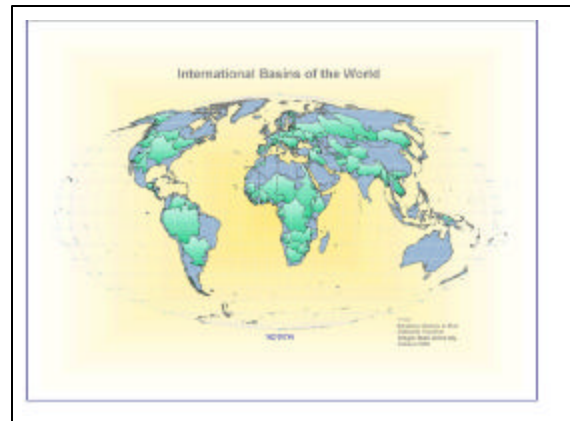
## Water and Conflict

"Fierce competition for fresh water may well become a source of conflict and wars in the future."

- Kofi Annan, March 2001

## Water Myths and Water Facts

### Myth 1: Water Wars are Prevalent and Inevitable

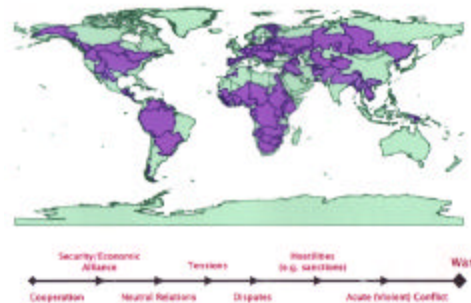


### Challenges of Transboundary Aquifers

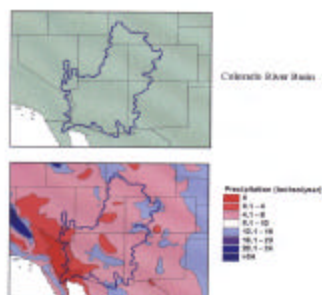


From Puri and others (2001).

### Scale of Conflict



### BASINS AT RISK: Spatial Variation



### The Transboundary Freshwater Dispute Database

A Project of  
Oregon State University  
Department of Geosciences  
and the Northwest Alliance for  
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- Reference to 3,600 water-related treaties (805-1997)
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- News files on cases of acute water-related disputes
- Indigenous methods of water dispute resolution



## Water Myths and Water Facts

### Myth 2: Everything is OK

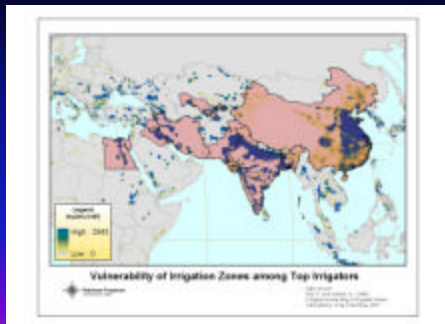
- Decades of tension, degradation, and inefficiency
- Conflict within and between multiple scales
- Regional instability in areas of security concern

## Conflict Within and Between Multiple Scales

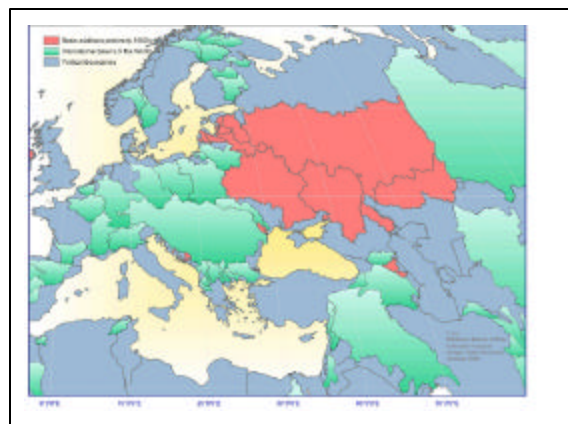
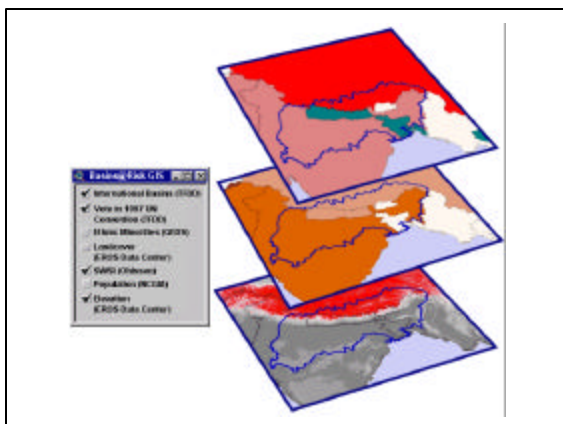
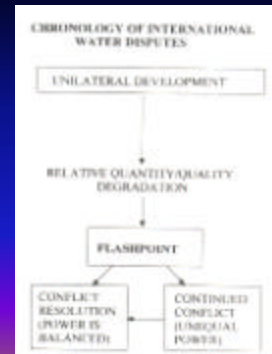


The smaller the scale, the greater the likelihood of violence.

## Regional Instability in Areas of Security Concern



## Decades of Tension, Degradation, and Inefficiency







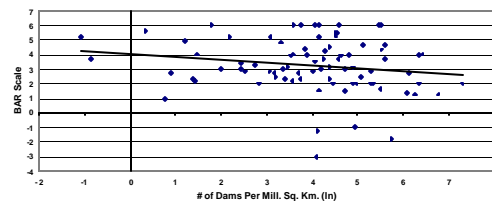
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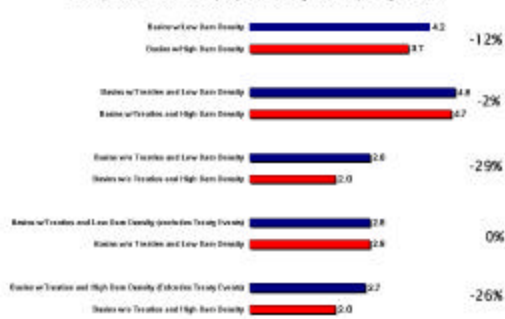
### Parameters which seem *not* to be indicators:

- Climate
- Water stress
- Population
- Level of development
- Dependence on hydropower
- Dams or development *per se*
- - “Creeping” changes:
  - general degradation of quality
  - climate change induced hydrologic variability

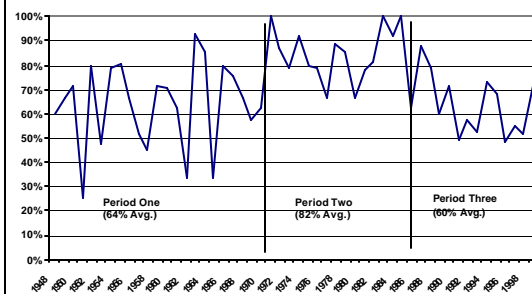
Dams Per Million Sq. Km. (ln) Vs. BAR Scale  
(By Basin)



Development and Institutional Capacity: Basins Settling and Corresponding BAR Scale



Cooperative Events as a Percentage of Total Events



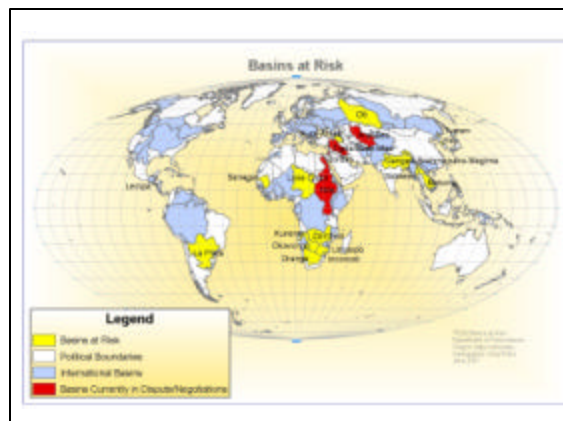
## BASINS AT RISK: Working Hypothesis

*“The likelihood of conflict rises as the rate of change within the basin exceeds the institutional capacity to absorb that change.”*

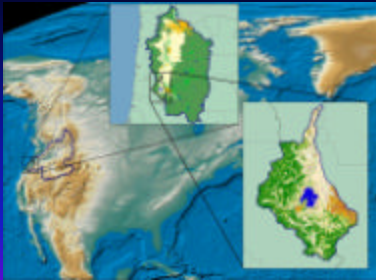
### What *are* indicators?

Sudden physical changes or lower institutional capacity are more conducive to disputes:

- 1) Uncoordinated development: a major project *in the absence* of a treaty or commission
- 2) “Internationalized basins”
- 3) General animosity



## Conflict Within and Between Multiple Scales

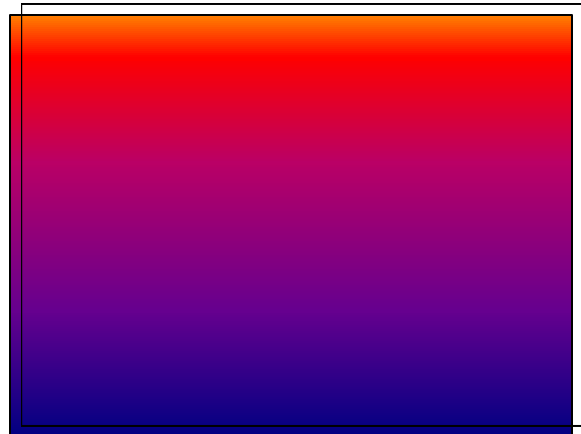
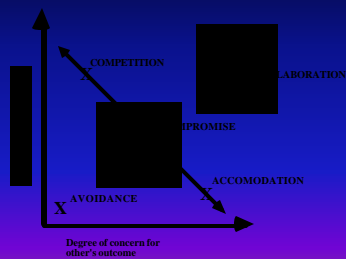


The smaller the scale, the greater the likelihood of tension.

## Types of Water Related Conflict

- Interpersonal Conflict
- Inter-sectoral Conflict
- Inter-agency Conflict
- Inter-state Conflict
- International Conflict

## STYLES OF CONFLICT MANAGEMENT



## UN CONVENTION ON NON-NAVIGATIONAL USES (1997)

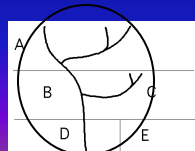
Reasonable and equitable use vs. Obligation not to commit harm

### Article 5: Equitable and reasonable utilization and participation

Watercourse States shall in their respective territories utilize an international watercourse in an equitable and reasonable manner.

### Article 7: Obligation not to cause significant harm

Watercourse States shall, in utilizing an international watercourse in their territories, take all appropriate measures to prevent the causing of significant harm to other watercourse States.



## ARI:

### Three Stages of Negotiations

- **Adversarial** – each side defines its positions, or rights (win-lose, zero-sum, distributive).
- **Reflexive** – the needs of each side bringing them to their positions is addressed.
- **Integrative** – negotiators brainstorm together to address each side's underlying interests (win-win, positive sum).

• Source: Rothman, J. 1991. Negotiation as Consolidation. *Journal of International Relations*, 13 (1).



# Criteria for Water Allocations

- Initial Positions:
  - Rights-based: Geography vs. Chronology
- Interim Positions:
  - Needs-based plus recognition of historic use
- Final Agreement:
  - Interest-based: Equal distribution of “baskets” of benefits

- Rights-based: Geography vs. Chronology

- Needs-based plus recognition of historic use

- Interest-based: Equal distribution of “baskets” of benefits

# PROCESS TECHNIQUES

- SEATING ARRANGEMENT
- SHARED VISION EXERCISES
- VENTING
- ACTIVE LISTENING
  - Repeat main points
  - "I" not "you"
  - Future not history
- IDENTIFY ALLIANCES
- BREAKS FOR CAUCUSING

- Repeat main points
- "I" not "you"
- Future not history

# GETTING TO “YES”

- **Separate the PEOPLE from the problem**
- **Focus on INTERESTS, not positions**
- **Invent OPTIONS for mutual gain**
- **Insist on Objective CRITERIA**

• Source: Fisher R. and W. Ury. GETTING TO YES. NY: Penguin, 1981.

- Source: Fisher R. and W. Ury. GETTING TO YES. NY: Penguin, 1981.

# CURRENT LAW: MOST BASIC RULES

**REFLECTED IN 1997 UN CONVENTION:**

***Article 5: Equitable and reasonable utilization and participation***  
Watercourse States shall in their respective territories utilize an international watercourse in an equitable and reasonable manner.

***Article 7: Obligation not to cause significant harm***  
Watercourse States shall, in utilizing an international watercourse in their territories, take all appropriate measures to prevent the causing of significant harm to other watercourse States.

***Article 11: Prior notification***  
Watercourse States shall exchange information and consult each other and, if necessary, negotiate on the possible effects of planned measures on the condition of an international watercourse.

### Article 5: Equitable and reasonable utilization and participation

### Article 7: Obligation not to cause significant harm


### Article 11: Prior notification

A map of the Sandus River basin. The map shows the Sandus Republic to the north, South Dumbli to the northeast, and Rosala to the south. Within the Sandus Republic, the regions of Damo and Ingia are labeled. The Sandus River is shown flowing from the north towards the south. A compass rose is located in the top right corner, and a scale bar is in the bottom right corner. The map is titled "Map of the Sandus River basin" at the top.





### I. Overview: Basins with Boundaries

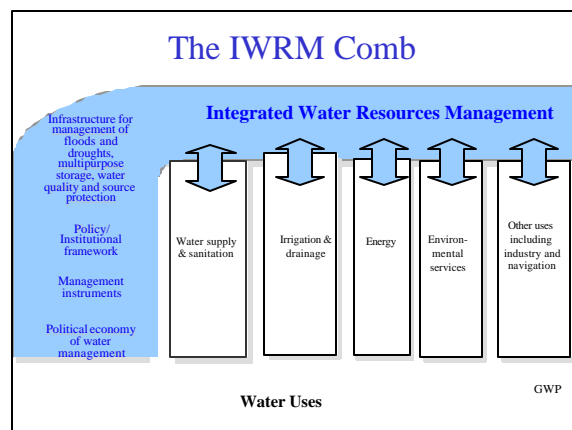


**Presentations:**


- Intro to Hydropolitics
- Intro to Negotiations

**Exercises:**

- Assessing a basin: Identifying parties, issues, interests
- Planning by nation



### II. Changing Perceptions: Basins Without Boundaries

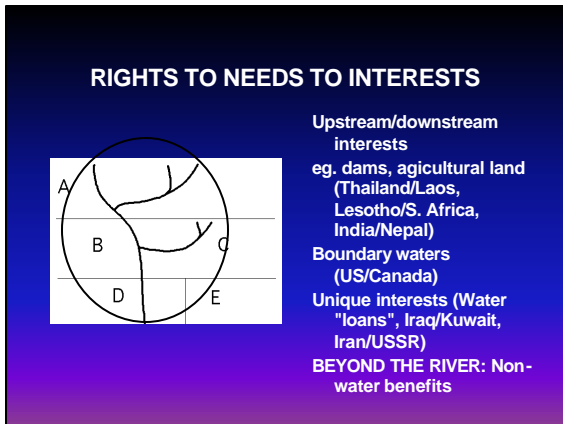


**Presentations:**

- Cooperative Framework
- Lessons Learned
- The New Diplomacy

**Exercise:**

- Thinking as a basin: Planning by sectors



	The Challenges	The Opportunities
<b>Type 1:</b> Increasing Benefits <i>To the river</i>	Limited water resour. management: degraded watersheds, wetlands, biodiversity, & water quality.	Improved water quality, overflow characteristics, soil conservation, biodiversity
<b>Type 2:</b> Increasing Benefits <i>From the river</i>	Sub-optimal water resources development	Improved hydropower & agricultural production, flood-drought management, environmental conservation & water quality
<b>Type 3:</b> Reducing Costs <i>Because of the river</i>	Tense (+/-) regional relations & political economy impacts	Policy shift to cooperation & development, from dispute; from food & energy self-sufficiency to security; reduced conflict risk & military expenditure (+/-)
<b>Type 4:</b> Increasing Benefits <i>Beyond the the river</i>	Regional fragmentation	Integration of regional infrastructure, markets & trade

Source: Sadoff and Grey 2003.

Benefits: the Ecological River		
	The Challenges	The Opportunities
<b>Type 1:</b> Increasing Benefits <i>To the river</i>	Limited water resour. management: degraded watersheds, wetlands, biodiversity, & water quality.	Improved water quality, riverflow characteristics, soil conservation, biodiversity

- cornerstone of river basin management
  - but many tradeoffs (pristine vs engineered)
  - unthreatening start for international cooperation
- many recent examples
  - GEF: Baltic & Red Seas; Danube
  - the Rhine – ‘Salmon 2000’
- watersheds & floodplains: the southern Africa case

Source: Sadoff and Grey 2003.

Benefits: the Economic River		
	The Challenges	The Opportunities
<b>Type 2:</b> Increasing Benefits <i>From the river</i>	Sub-optimal water resources development	Improved hydropower & agricultural production, flood-drought management, environmental conservation & water quality

- Optimal river development at basin scale
  - Again difficult tradeoffs – best at basin scale
  - NOT zero-sum; increasing water availability
- Focus on benefits (\$), not water (m<sup>3</sup>)
- Many examples (w. tradeoffs!)
  - the Senegal Basin: co-owned infrastructure assets;
  - Lesotho Highlands: royalties to Lesotho (5% of GDP); SADC PowerPool
- Challenge: sharing benefits & ‘fairness’

Source: Sadoff and Grey 2003.

Benefits: the Political River		
	The Challenges	The Opportunities
<b>Type 3:</b> Reducing Costs <i>Because of the river</i>	Tense (+/-) regional relations & political economy impacts	Policy shift to cooperation & development, from dispute; from food & energy self-sufficiency to security; reduced conflict risk & military expenditure (+/-)

- Always some tensions in all international rivers (but +/-)
  - control: sovereignty, strategic necessity, national pride
  - ‘nothing flows’: fragmented markets, infrastructure, labor flows
- Extreme cases: military preparedness
- Shared water one contributory factor in relations between states (cannot ‘unbundle’):
  - Water can contribute to dispute, even conflict (Indus, Jordan, Euphrates, Nile)
  - Water can be catalyst for cooperation & integration

Source: Sadoff and Grey 2003.

Benefits: the Catalytic River		
	The Challenges	The Opportunities
<b>Type 4:</b> Increasing Benefits <i>Beyond the the river</i>	Regional fragmentation	Integration of regional infrastructure, markets & trade

- Cooperation → political processes enabling other cross border cooperation beyond the river
- Directly: through forward linkages:
  - Agricultural surpluses → growth in agri-business & trade
  - HP generation/trade → expanded/profitable industry
- Indirectly: diminished tensions may enable greater economic integration
  - ‘increasing flows’ in unrelated sectors
  - the Mekong case

Source: Sadoff and Grey 2003.

### III: Growing and Sharing Benefits



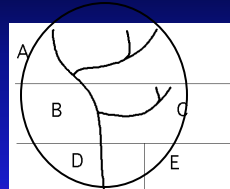
#### Presentations:

Economics of Int'l waters  
Equity, Efficiency, and  
Thinking Beyond the River

#### Exercises:

Growing benefits

### INSTITUTIONAL MODELS



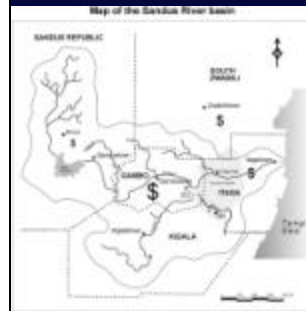
- Unilateral Development
- Coordinated Management (eg. Jordan)
- Integrated Watershed Management (eg. Schelde, Mekong)

### Integration versus Transaction Costs: Transboundary Management Structures

(after Fetteson, forthcoming)

Structure	# of Tasks	Potential for Disagreement	Sovereignty Infringement	Transaction Costs
Watershed Monitoring	Single	Low	None	Low
Technical Research Coordination	Single	Low	None	Low
Resource Conservation	Single	Low	None	Low
Training Center	Single	Low	None	Low
Appointment Body	Single	High	Limited*	Medium*
Arbitration Body	Single	High	Limited*	Medium*
Appointment Monitoring	Single	Moderate	None	Low-Medium
Investigative Advisory Body	Few	High	Limited	Medium
Risk Management	Few	High**	Limited	Medium
Political Control	Many	Moderate*	Significant*	High*
Joint Regulatory Bodies	Several	High	Major	Very High
Wastewater Utility	Several	Moderate	None	Medium
Water Utility	Several	Moderate	None	Medium
Economic Development	Several	Moderate-High*	Limited	Medium-High
Project Management	Several	High	Limited	Medium-High
Water Transfers or Markets	Several	Moderate	Limited	High***
Comprehensive Utility	Many	High	Limited	High***
Integrated Watershed Management	Many	Very High	Major	Very High
Centralized Joint Management	Many	Very High	Major	Very High

### IV. Putting it all Together: Institutional Capacity



#### Presentations:

Int'l Water Law

Institutions in Practice,  
Track II, Stakeholder  
Participation

#### Exercises:

Crafting Institutions

"Forgotten" and  
Unforeseen Issues





### Global Water Crisis

- Almost 3 billion people lack access to adequate sanitation
- >1 billion people lack access to safe drinking water
- At least 250 million illnesses result
- 5-10 million deaths
- 20% of irrigated lands are salt-laden
- Water-related disease costs US\$125 billion/yr.
- Would “only” cost US\$7-50 billion/yr. to resolve

### Water and Cooperation

“But the water problems of our world need not be only a cause of tension; they can also be a catalyst for cooperation

....If we work together, a secure and sustainable water future can be ours.”

- Kofi Annan, February 2002



# Managing Conflicts In Water Management: Two Current Case Studies

Daniel P. Loucks  
Cornell University

- South Florida Regional Water Management - Including Everglades Restoration Project
- Lake Ontario – St. Lawrence River Water Management
- Conclusions: Common Approaches to Dealing with Conflicts



## Regional System of South Florida

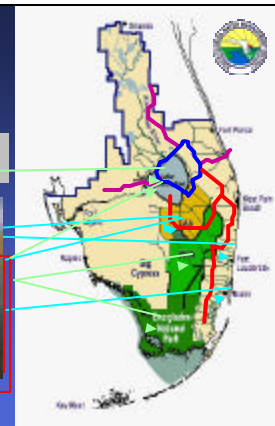
Water management goals:

- Water Supply
- Flood Protection
- Environment
  - CERP



## Lake Okeechobee is a Regional Multiple Purpose Water Resource

In lake Environment & Recreational Use

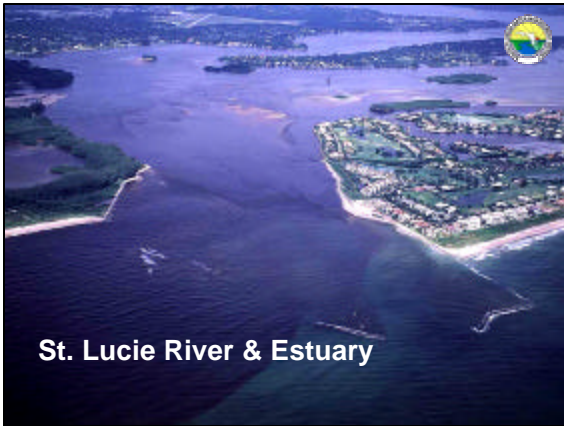


Lake Okeechobee Service Area  
Agriculture



EAA Sugar Cane





**Development of Operating Rules for Lake Okeechobee**

Multiple Objectives

**Potential Predictors of Lake Okeechobee Net Inflow**

- El Nino / La Nina
- Solar indices
- Atlantic Ocean Thermohaline Current
- Pacific Decadal Oscillation

# Lake Inflow vs. El Nino/La Nina

# Geomagnetic activity correlation to rainfall in Lake Okeechobee

an Index

40  
35  
30  
25  
20  
18  
10

1924 1928 1932 1936 1940 1944 1948 1952 1956 1960 1964 1968 1972 1976 1980 1984 1987

1929-30 M  
41-42 M  
55-56 M  
63-64 M  
73-74 M  
89-90 M  
91-92 M  
93-94 M  
95-96 M

VW = Very Wet  
W = Wet  
D = Dry  
VD = Very Dry

Geomagnetic Activity (an Index)

Sunspot Number

Note: Wet and dry period labels are only positioned in and around the apparent maximums of their respective and the 11 year solar cycle and geomagnetic activity. The magnitude of Lake Okeechobee rainfall for each year appears in Table 3.

Schematic diagram of the global ocean circulation pathways, the conveyor belt (after W. Broecker, modified by G. Stoker, 1992)

AW 2005

# Lake Okeechobee Inflow Versus Climate Indicators

Figure 1. Lake Okeechobee Inflow Versus Climate Indicators  
May through October

The box plot displays the distribution of inflow depth (ft) for two levels of geomagnetic activity (Cp): Low and High. The y-axis ranges from -2 to 10 ft, with a dashed horizontal line at 4 ft. The x-axis is labeled 'Geomagnetic Activity (Cp)'. The plot is divided into two sections: 'Weak Thermohaline Current' on the left and 'Strong Thermohaline Current' on the right. Each section contains two box plots for 'Low' and 'High' geomagnetic activity. The 'High' geomagnetic activity plots show significantly higher inflow depths, with the 'Strong Thermohaline Current' 'High' plot extending above 8 ft.

Thermohaline Current	Geomagnetic Activity (Cp)	Min	Q1	Median	Q3	Max
Weak Thermohaline Current	Low	-0.5	-0.5	0	0.5	1.5
	High	0.5	0.5	1.5	4	5.5
Strong Thermohaline Current	Low	-1.5	0.5	1.5	4.5	5
	High	0.5	1	3.5	8.5	9

# CPC: One Month and Three Months Windows

**Climate Outlook**

Source: National Oceanic and Atmospheric Administration, National Centers for Environmental Prediction, Climate Prediction Center. The Climate Prediction Center (CPC) is a part of the National Centers for Environmental Prediction (NCEP) and is responsible for the production and dissemination of climate forecasts and outlooks. The CPC is a part of the National Centers for Environmental Prediction (NCEP) and is responsible for the production and dissemination of climate forecasts and outlooks.

It takes time for the CPC to produce and disseminate its climate forecasts and outlooks. The CPC is a part of the National Centers for Environmental Prediction (NCEP) and is responsible for the production and dissemination of climate forecasts and outlooks.

**Legend:**

One Mo.	Three Mo.	Precipitation anomalies (deviation from 1981-2010)	Precipitation anomalies (deviation from 1981-2010)	Other Data
0.00	0.00	0.00	0.00	0.00
0.25	0.25	0.25	0.25	0.25
0.50	0.50	0.50	0.50	0.50
0.75	0.75	0.75	0.75	0.75
1.00	1.00	1.00	1.00	1.00
1.25	1.25	1.25	1.25	1.25
1.50	1.50	1.50	1.50	1.50
1.75	1.75	1.75	1.75	1.75
2.00	2.00	2.00	2.00	2.00
2.25	2.25	2.25	2.25	2.25
2.50	2.50	2.50	2.50	2.50
2.75	2.75	2.75	2.75	2.75
3.00	3.00	3.00	3.00	3.00
3.25	3.25	3.25	3.25	3.25
3.50	3.50	3.50	3.50	3.50
3.75	3.75	3.75	3.75	3.75
4.00	4.00	4.00	4.00	4.00
4.25	4.25	4.25	4.25	4.25
4.50	4.50	4.50	4.50	4.50
4.75	4.75	4.75	4.75	4.75
5.00	5.00	5.00	5.00	5.00
5.25	5.25	5.25	5.25	5.25
5.50	5.50	5.50	5.50	5.50
5.75	5.75	5.75	5.75	5.75
6.00	6.00	6.00	6.00	6.00
6.25	6.25	6.25	6.25	6.25
6.50	6.50	6.50	6.50	6.50
6.75	6.75	6.75	6.75	6.75
7.00	7.00	7.00	7.00	7.00
7.25	7.25	7.25	7.25	7.25
7.50	7.50	7.50	7.50	7.50
7.75	7.75	7.75	7.75	7.75
8.00	8.00	8.00	8.00	8.00
8.25	8.25	8.25	8.25	8.25
8.50	8.50	8.50	8.50	8.50
8.75	8.75	8.75	8.75	8.75
9.00	9.00	9.00	9.00	9.00
9.25	9.25	9.25	9.25	9.25
9.50	9.50	9.50	9.50	9.50
9.75	9.75	9.75	9.75	9.75
10.00	10.00	10.00	10.00	10.00
10.25	10.25	10.25	10.25	10.25
10.50	10.50	10.50	10.50	10.50
10.75	10.75	10.75	10.75	10.75
11.00	11.00	11.00	11.00	11.00
11.25	11.25	11.25	11.25	11.25
11.50	11.50	11.50	11.50	11.50
11.75	11.75	11.75	11.75	11.75
12.00	12.00	12.00	12.00	12.00
12.25	12.25	12.25	12.25	12.25
12.50	12.50	12.50	12.50	12.50
12.75	12.75	12.75	12.75	12.75
13.00	13.00	13.00	13.00	13.00
13.25	13.25	13.25	13.25	13.25
13.50	13.50	13.50	13.50	13.50
13.75	13.75	13.75	13.75	13.75
14.00	14.00	14.00	14.00	14.00
14.25	14.25	14.25	14.25	14.25
14.50	14.50	14.50	14.50	14.50
14.75	14.75	14.75	14.75	14.75
15.00	15.00	15.00	15.00	15.00
15.25	15.25	15.25	15.25	15.25
15.50	15.50	15.50	15.50	15.50
1				

## Accuracy of CPC forecasts

Window	Correct (%)	Wrong (%)
1	67%	33%
2	69%	31%
3	60%	40%
4	39%	61%
5	27%	73%
6	42%	58%
7	44%	56%
8	36%	64%
9	40%	60%
10	80%	20%
11	25%	75%
12	25%	75%
13	50%	50%

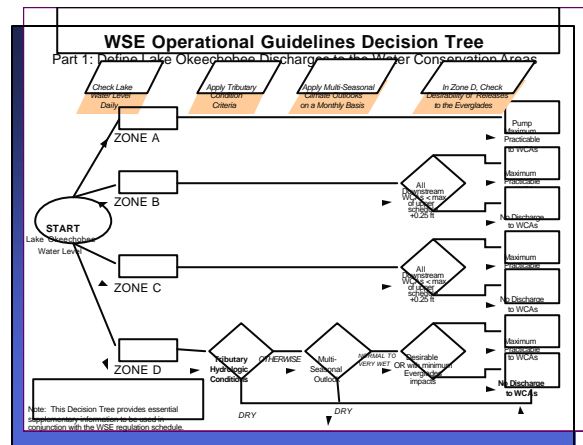
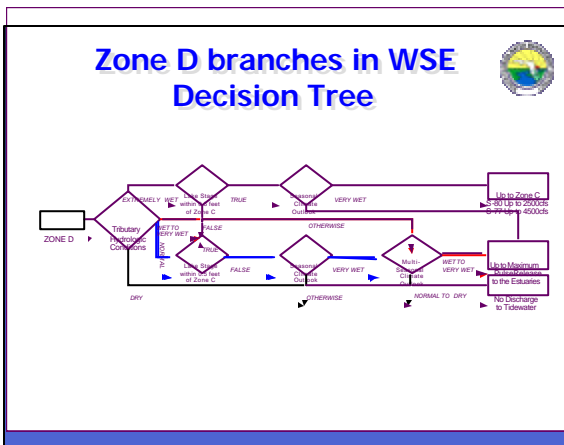
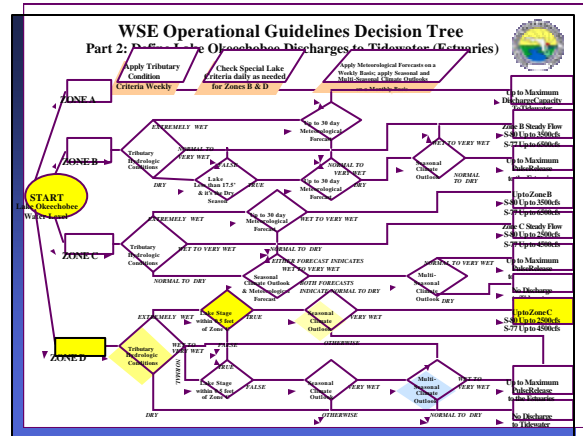
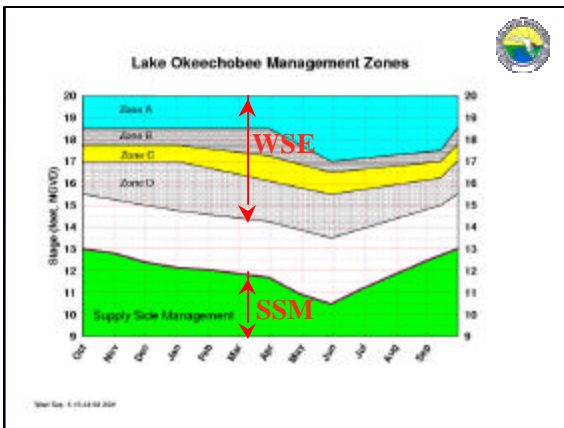
\* Based 1/95-7/02 CPC forecasts & south Florida rainfall



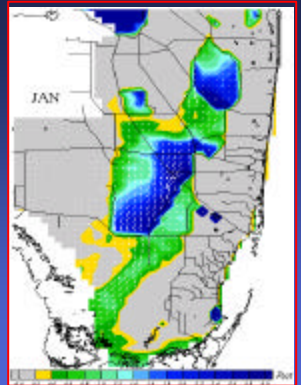
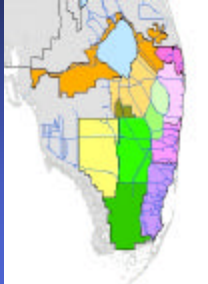


## WSE Regulation Schedule Operational Elements

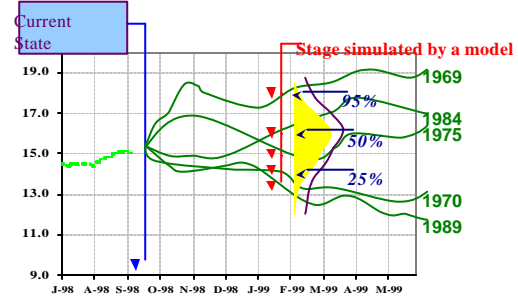
- Lake Okeechobee Water Level
- Tributary Hydrologic Conditions
  - 30 Day Net Rainfall
  - Average Kissimmee River inflow
- Lake Okeechobee Net Inflow Outlook
  - Seasonal Outlook (6 months)
  - Multi-seasonal Outlook (7 to 12 months)



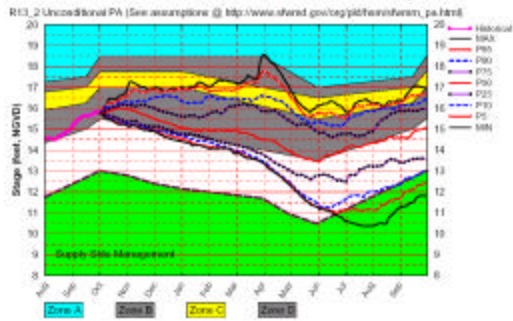
## Regional System Models



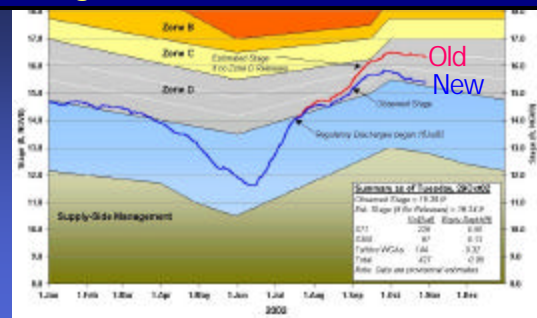
## POSITION ANALYSIS



## Lake Okeechobee SFWM Oct 2002 Position Analysis



## Does the new Climate Based Lake Regulation Make A Difference?



## Development of Operating Rules for Lake Okeechobee

### Multiobjective Tradeoff Analysis



## Weekly Decision Making

- Mult-agency, Multi-disciplinary Team:
  - Meteorologists
    - Rainfall conditions, up to 2-week forecasts, status of hurricanes/tropics
  - Hydrologists
    - Current hydrologic conditions
    - Tributary condition
    - Climate Outlook (Seasonal, Multi-seasonal)
  - Biologists
    - Ecological condition of lake Okeechobee
    - Salinity levels in Estuaries
    - Ecological condition of the Everglades
  - Operators
  - Lawyers and politicians

## Challenges

- Tools & Methods: Stakeholder buy-in is a challenge
- Adaptive management methods within legally binding rules is difficult
- Operators do not like flexibility. They want a 'cook book'- liability issue
- Decision makers do not like uncertainty.
- Public wants their objectives met.
- Lawsuits result no matter what is done.

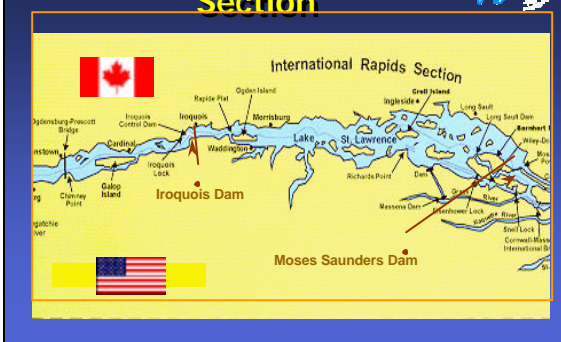
## Lake Ontario - St. Lawrence River Water Levels Study



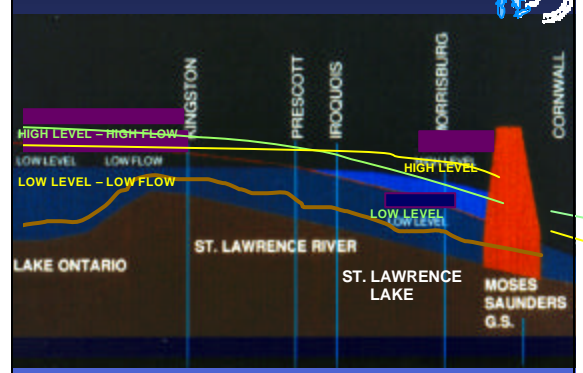
*The International Joint Commission*

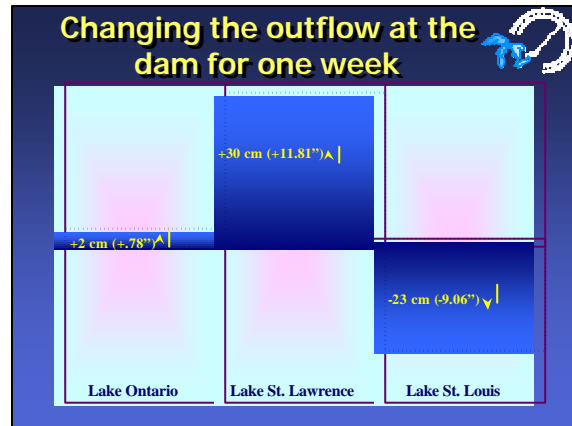
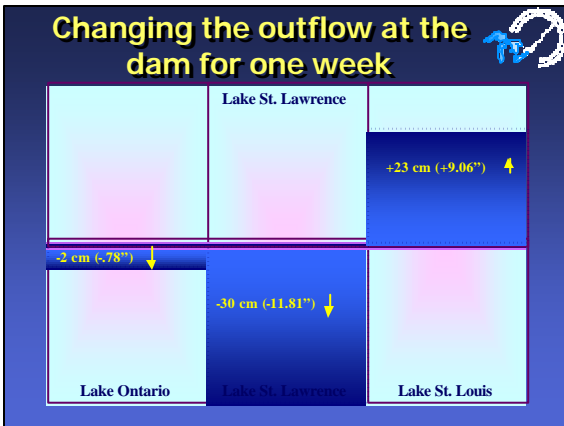


## International Rapids Section



## Upper St Lawrence River Profile





## The Current Regulation Plan

### Plan 1958-D

- Based upon 1950's technology
- Designed prior to any practical experience with regulating the Lake and River over time
- Guided by the political, social and economic climate of the 1950's
- In effect since 1963

## Why does Plan 1958-D need revision?

- New objectives, new issues.
- Since in operation, deviations from Plan 1958-D have occurred over 50% of the time.

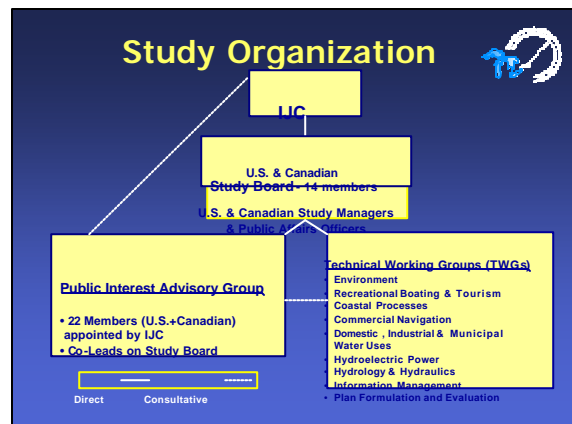
*(much of this due to accommodating for additional interests)*

## How is the Operating Plan being revised?

Five-Year \$20 Million Study involving

- Joint Canadian-US Study Board
  - Nine Technical Working Groups
- Public Interest Advisory Board
- Public stakeholders

Overseen and sponsored by the IJC



## The IJC 'Style'



- Consultation and consensus-building
- Providing for public participation
- Joint fact-finding
- Objectivity and independence
- For the greater good of both countries

## Major Challenges



- Geographic, cultural and language differences
  - Working toward a shared vision
- Complexity of the system
  - Opposite effects - same time, different locations
  - Changing climate
- Time horizon
  - Moving targets – changing criteria,
- Multiple, and often conflicting, public interests

## Environment



## Recreational Boating & Tourism



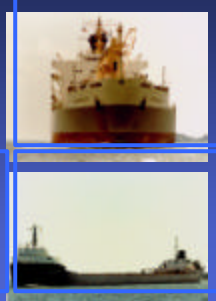
## Coastal Erosion and Protection



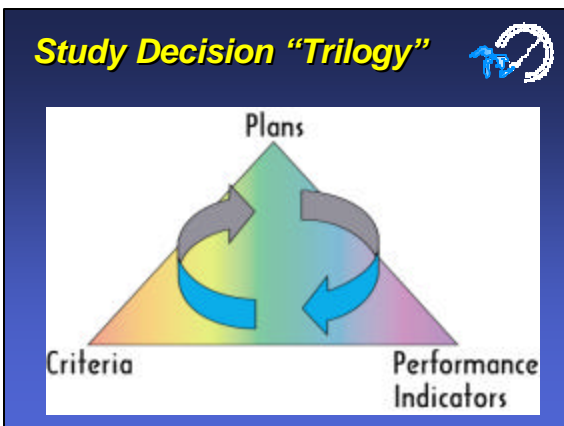
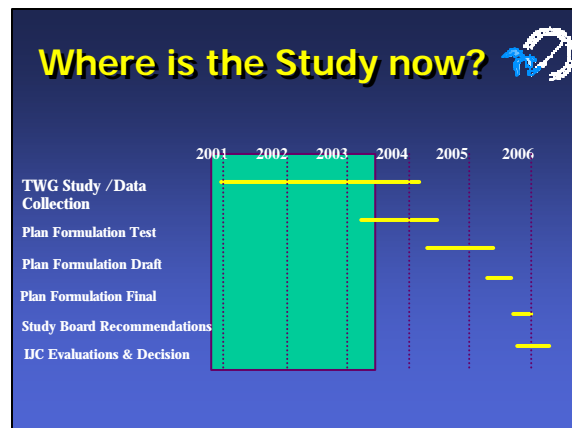
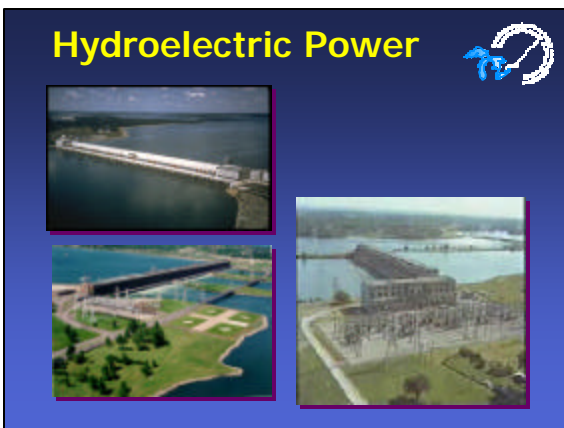
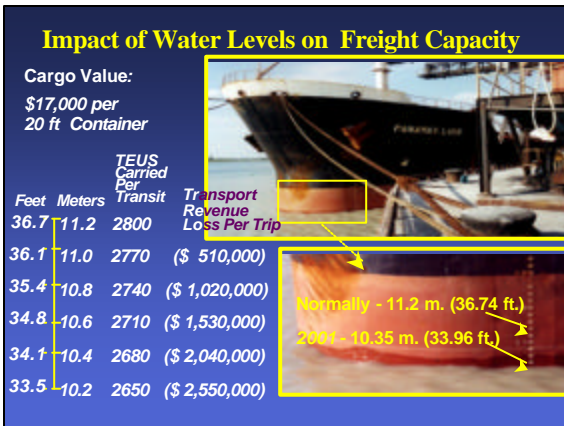
## Commercial Navigation



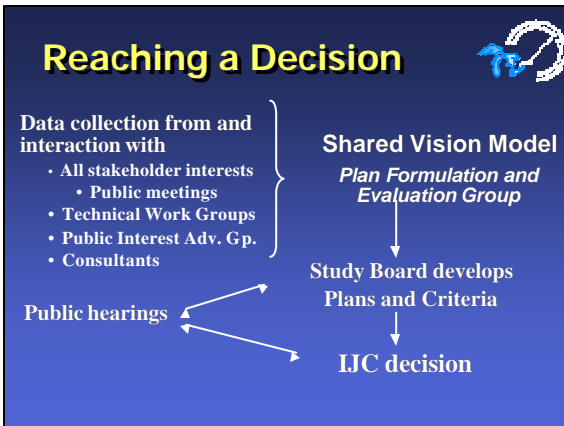
"Two factors are critical to safe and efficient navigation: the available depth of water, and the currents created by water flow."







- ### Selected Performance Indicators from TWGs
- Coastal – Erosion/flooding economic impacts.
  - Environmental - Wetland breeding bird populations and assemblage diversity, including rare and endangered species.
  - Hydropower – Megawatts of power.
  - Recreational Boating - Economic benefits of small boat recreation.
  - Commercial Navigation - Economic benefits associated with transportation cost savings.
  - Municipal & Industrial Water Uses - Value of lost water supply services.



## Conclusions

### Dealing with Conflict:

- Involve public – public education: hard, time-consuming but potentially beneficial.
- Shared Vision goals and modeling.
- More efficient management, inflow forecasting, operations.
- Decisions backed by research – peer reviewed research.
- Conflict will remain, but perhaps less misunderstanding of necessary tradeoffs.

## Questions?

## Tools of the Trade



## Tools for Managing Water Better:

- Cheaper (cost effectiveness)
- More net benefits (however measured)
- Less wastage of water and energy.
- Less conflict
- More reliability
- More resilience
- Less risk should failure occur (less vulnerability)

### Tools:

- Documents, publications, manuals, internet, search engines, data mining
- Optimization and simulation models, (GIS, DSS, Shared Vision Models)
- Monitors, remote sensing
- Desalination technology
- Conjunctive surface-groundwater management
- Appropriate technology for
  - enhancing water supply, e.g. water harvesting, reuse
  - reducing water use (including irrigation) demand
  - controlling waterlogging and salinity,
- Weather and climate forecasting
- Cloud seeding
- Public participation methods

### Tools:

- Legal and institutional tools
- Public health measures
- Ecological reserves
- Drought prevention and mitigation measures
- Flood management measures including telematics technology
- Pollution control and prevention measures
- Geomorphologic and biogeomorphologic models
- Chaos theory, neural networks and fuzzy logic models
- Evolutionary optimization models and methods
- Information and communication technology and distance learning

## And most importantly:

### Capacity:

- Enlightened, informed stakeholders
- Trained and motivated professionals in multiple disciplines
- Effective managers, leaders

## Shared Vision Modeling

### for:


- Stakeholder confidence and ownership
- Common vision of system operation and impacts of alternative policies.
- ? Common vision of how system should be developed, managed, operated.

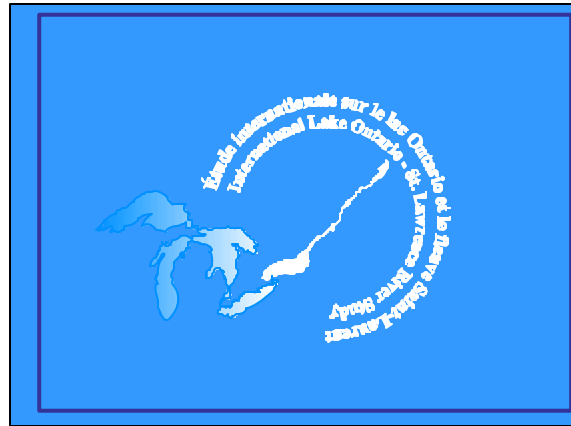




## Tools of the Trade

Decision Support Systems

Shared Vision Models





# PIZZA

## FORMULATION AND EVALUATION

### PLAN 1958D-with/Deviations




*We'll start with a basic recipe.*

### Pizza

#### Formulation Team

Let's make a new better pizza.

We're tired of plain, old pepperoni pizza.



I want mushrooms, green pepper and pepperoni.

I'd like green olives, chili peppers and tomatoes

I love ham and pineapple.

BLAH!

BLAH!

YUCK!

How about onions and bacon?

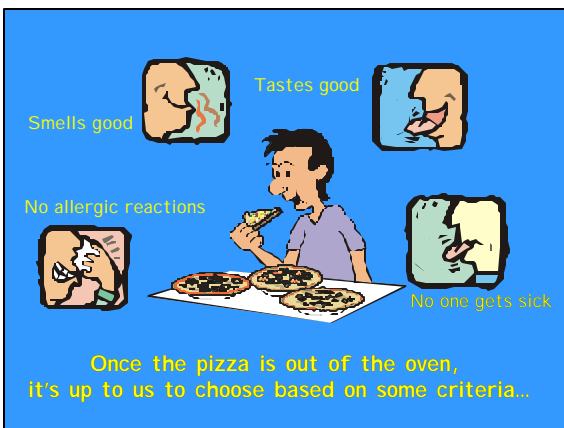
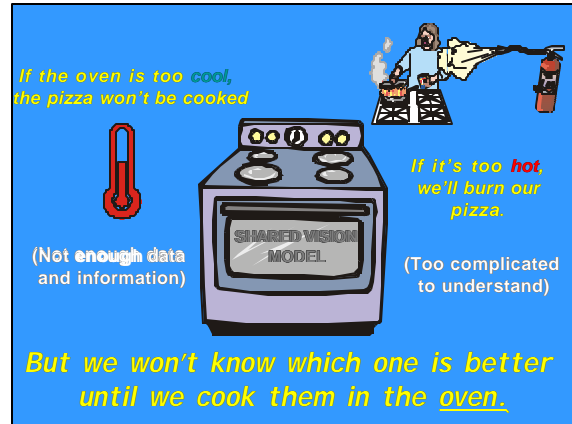
Onions give me gas!

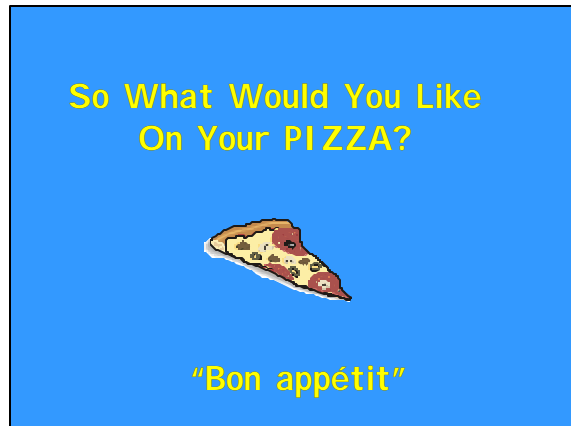
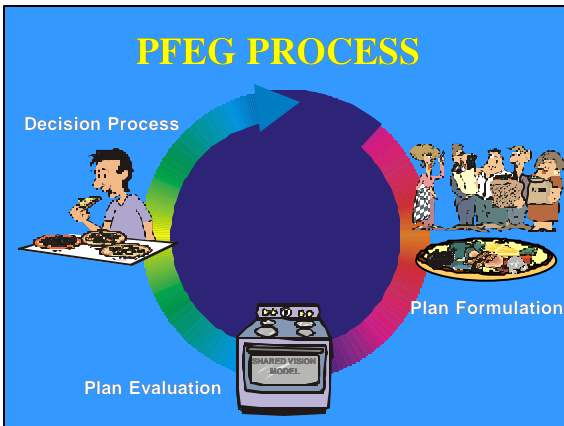
I'm allergic to pineapple

Anchovies and garlic for me.



### How will we ever decide?





## Federal–State Water Resources Issues

## Water organizations

- Federal roles
- State roles
- Local roles—water service organizations
- Many other stakeholders

## Issues that surfaced during the meeting

- ESA consultations-- OCAP
- Biological opinions--Columbia River
- Middle Rio Grande
- CBT--lawsuits
- California -- Colorado River delivery
- Agriculture v Urban

## Arguments for collaboration

- Water 2025 --Principle 1: respect state and federal water rights, contracts, and interstate compacts.
- Principle 4: Collaborative approaches
- Principle 6: ... eliminating institutional barriers to storage and delivery of water to other uses while protecting existing uses and stakeholders.

## Realities

- Reality 1: Explosive population growth—areas like Phoenix, Las Vegas, Los Angeles, Denver, Salt Lake, Boise, and Albuquerque.
- Reality 3: ...bitter conflicts that divide neighbors and put important environmental resources at risk.
- Reality 5: Crisis management is not effective in dealing with water conflicts.

## Tools

- Tool 2: Collaboration— collaborative approaches help to resolve conflict

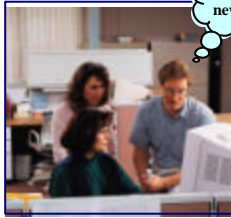
### Possible conclusions

- Partnerships. Better up front collaboration needed between states and USBR
- Role clarification. Clarify positions of separate and federal state agencies to seek unified positions. Sort out state v federal regulatory roles.
- Data management. Is there a role for USBR?

### Conclusions (cont'd)

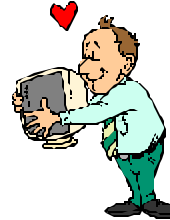
- Modeling. Seek mandate for USBR to model rivers it manages
- Benchmarks for water use efficiency.
- Coordinate financial policy
- Share responsibilities on security
- Training for USBR on planning and collaboration

### Water Resource Modeling and Optimization



### Major Discussion Topics

- Emerging Needs in Modeling
- Linking Models Together
- Communication of Model Purposes and Results
- Needs of the Modelers



### Emerging Needs in Modeling

- Water accounting, water rights & storage accounts
- Groundwater & conjunctive use
- Water quality & ecosystem
- Delta hydraulics

### Linking Models Together

- Many models exist– how do we effectively link them together
- Different time and spatial scales
- Different accuracy – error propagation
- Where to find the data

### Communication of Model Purposes and Results

- How to best communicate results
- Asking for models before the problem is defined
- Shared vision modeling to get all parties together
- Gaming as a way to better understand the decision process

### Needs of the Modelers

- Not enough experienced modelers & funding
- Technology is changing rapidly and problems are more difficult
- Need for training on the development and use of linked models
- Increasing the activity and visibility of modelers
- Sharing information

Questions ???



## Collaboration in Water Data Collection and Sharing

Robert Ward

Asst: Jeff Rieker

## Outline of breakout session

- Overview of recent publication by National Water Quality Monitoring Council
  - Graphical view of data collection and sharing process
  - Goal: data consistency and comparability to support good management decisions
- Discussion of key issues

## Key Issues Discussed

- Data sharing
  - 'Data swaps'
  - Metadata
  - Communication – importance of getting the data to the public and illustrating what is significant about it

## Key Issues Discussed

- Integration of data collection efforts
  - Recent efforts outside the U.S.
  - Coordinated Monitoring Projects
  - Sharing cost
  - Getting credit for collection and use of the data

## Key Issues Discussed

- Supply Chain Software
  - Improved automation of entire monitoring process
  - Real-time use and dissemination of data
- Problems with data / data sharing
  - Differing purposes; Monitoring vs modeling
  - Differing agency goals

## Key Issues Discussed

- Role of peer review
  - Especially in cases where data may be part of a conflict or crisis
  - Consistency, comparability, credibility
- Publication of data, collection methods
  - Usability of data in future
- Documentation of design
  - Help sustain program through political change and budget cuts



## BUREAU OF RECLAMATION Pacific Northwest Region



## BUREAU OF RECLAMATION Indian Water Law Issues



- Ron Eggers
- PN Region
- Lower Columbia Area Office

## Topics of Discussion

- Indian Law
- Trust Responsibility
- Consultation-Rules and Responsibilities
- Water Law Principles



## The Basics of Indian Law

- The Commerce Clause
- Treaties
- Federal Reservations
- Case Law
- "Consultation"
- Administrative Differences

## FEDERAL INDIAN LAW Basic Elements

- The Trust Relationship
- Tribal Government Status
- Reserved Rights Doctrine
- Canons of Construction
- Congress' Plenary Power

## Trust Relationship

- Articles of Confederation 1781
- Constitution, Article I, Section 8
- Indian Trade & Intercourse Act of 1790
- Marshall Trilogy

## Tribal Government Status

- Indian Tribe
- Indian
- Indian Country
- Sovereignty

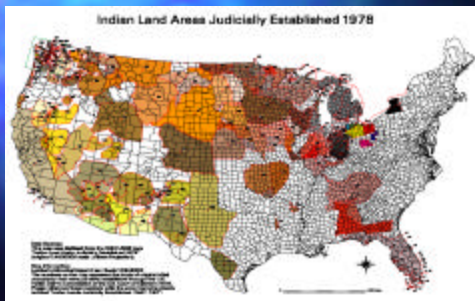


## Tribal Government Status cont'd

- Sovereignty
  - Inherent, reserved or aboriginal
  - Limited
  - Members and reservation
  - Off-reservation activities



## Judicially Established Indian Land Areas In The Northern Plains - Aboriginal Homelands -



## Tribal Sovereignty

Tribal governments are sovereign. Tribes constitute "distinct political" communities "that may, more correctly, perhaps, be denominated domestic, dependent nations" whose "relation to the United States resembles that of a ward to his guardian" (*Cherokee Nation v. Georgia* [1831]).



Tribal elders in the first car on the Rosebud Sioux Reservation-1910

## TRUST RESPONSIBILITY

### TRUST RELATIONSHIP DEFINED

## Trust Responsibility

- Evolved judicially
  - *Cherokee Nation v. Georgia*
  - *Worcester v. Georgia*
- The "Tied Rationally Standard"
- Canons of Construction
- Limits of Federal Administrative Power

## Trust Responsibility

- Tribes are independent political entities
- Congress may regulate or modify
- Power to regulate is wholly federal
- Federal responsibility to protect

## Trust Responsibility Definition

- Fiduciary obligations
- Treaty and statutory obligations of the U.S.
- Other legal obligations
- Trust assets identification

## Trust Responsibility

- It is the policy of the Department of the Interior to recognize and fulfill its legal obligations to identify, protect, and conserve the trust resources of federally recognized tribes and tribal members, and to consult with tribes on a government-to-government basis when plans or actions affect tribal trust resources, trust assets, or tribal health and safety. 512 DM 2.1



## Trust Responsibility



Receiving annuities - Standing Rock Reservation, 1890s

## TREATY AREAS & CEDED LANDS



The Sioux  
Tribes and  
the Great  
Sioux Nation

## Trust Responsibility Indian Trust Assets

- Legal interests in property
- Secretary is trustee
- All Bureaus have duty to protect
- Consultation required

### Reclamation Realizes Its Trust Responsibility Primarily Through:

- K Its Indian Trust Asset (ITA) policy
- K Environmental legislation, such as the National Environmental Policy Act and the National Historic Preservation Act
- K P.L. 93-638 - the Indian Self-Determination and Education Assistance Act

### INDIAN TRUST ASSETS

"... legal interests in property held in trust by the United States..."

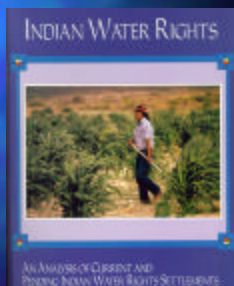
#### LEGAL INTERESTS INCLUDE:

FISH & WILDLIFE, PLANTS  
MINERALS  
TIMBER  
LAND



### Indian Trust Assets

- Finally, trust assets can include water secured through water rights adjudications with states.



### Trust Management Principles

- Protect ITAs from loss, damage, unlawful alienation, waste, and depletion.
- Consult with tribes whenever plans or actions affect ITAs.
- Promote tribal control and self-determination over tribal trust lands and resources.
- Enforce agreements that provide for the use or protection of trust assets.

### Trust Management Principles

- Protect treaty-based fishing, hunting, gathering rights
- Maintain verifiable records and communicate with tribe

### BUREAU OF RECLAMATION Legal Relationship with Tribes

- Relationship based on:
  - Tribal sovereignty
  - Gov't to gov't relationship
  - Trust responsibility
  - Indian trust assets





## Consultation Principles



## Consultation

- Policy-
  - Respect tribal sovereignty
  - Consult to the greatest extent practicable
- Practice-
  - Government-to-government
- Problems-
  - Establishing a protocol
  - Understand cultural differences
  - Organize the effort; plan the outcome

## CONSULTATION WITH INDIAN TRIBES

- Reclamation's Indian Policy
- E.O. 13175 Consultation and Coordination with Indian Tribes
- Practice Tips

## Reclamation's Indian Policy

- Comply with letter and spirit of law
- Acknowledge and affirm special relationship
- Actively seek partnerships
- Ensure opportunity to participate
- Support tribe's effort to manage its own resources

## Consultation RECLAMATION *Indian Policy*

- Government-to-Government
- Trust Resources
- Protocol/Consultation
- Self-Determination/Self-Governance
- Religion/Culture
- Opportunity to Work Together
- Incorporate this Policy into Activities

## CONSULTATION *Trust Resources*

- Trust Asset Protection
- Water Rights
- Tribal Trust and the ESA

### Consultation *Practice Tips*

- Pre-meeting Activities
- Meeting Logistics
- Meeting Closure/Consensus
- Post-Meeting Follow-up
- Consideration of Protocol Agreement

### Consultation *Religion/Culture*

- Sacred Sites
- Human Remains and Cultural Items
- Cultural Resources

### Consultation *Executive Order No. 13175*

- Fundamental Principles
  - U.S. has a unique legal relationship
  - Recognized right to self-govern
  - Government-to-Government relationship
  - Supports sovereignty and self-determination

### Consultation *PROTOCOL- Practice Tips*

- Tribal Perspective
- Education
- With Whom do you Consult
- When and How
- Range of Consultation Contexts

### Federal Indian Water Law

### Treaties with Indians/Tribes

- Stevens Treaties
- Hellgate Treaties
- Ft. Bridger Treaties
- Reserved Rights

## Case Law

- Cherokee Nation Cases
- Jurisdictional Cases
- Water Law Cases
  - Winters
  - Others
- Fishing Rights Cases

## Indian Water Rights Adjudications

- Process
- Principles
- Claims
  - PIA, aboriginal, Winters, streamflow
- Conflicts and protests

## PROCESS & PROCEDURE

- Establishing a negotiation team
- Criteria and Procedures
- Establish a Negotiation Protocol
- Develop a Technical Protocol
- Prepare Fact Finding Report
- Negotiate, evaluate, concur
- Draft a Compact for State approval
- Allocate costs
- Draft Federal legislation.

## Trust Responsibility

- The Trust Relationship
- Tribal Government Status
- Reserved Rights Doctrine
- Canons of Construction
- Congress' Plenary Power

## RECLAMATION's Consultation Policy

- Government-to-government
- Trust resources
- Protocol as guidance
- Self-determination/self governance
- Religion and culture important
- Opportunity to work together
- Incorporate this policy into all activities

## BUREAU OF RECLAMATION



- Ron Eggers
- Pacific Northwest Region

## Environmental Justice and Sacred Lands: Authority, Policy and the Collaborative Approach

Developed by: Deldi Reyes, Region 8  
Nicholas Targ, Esque, OEJ

US Environmental Protection  
Agency, May 2003

## U.S. Environmental Protection Agency

- ❑ What is environmental justice?
- ❑ Can impacts to cultural resources be disproportionate and adverse?
- ❑ So what?
  - ✓ Can cultural resources authorities be used in an environmental justice framework?
  - ✓ Can a collaborative model work when regulatory approaches fall short?

## What is... Environmental Justice?

Fair treatment and meaningful involvement of people of all races & incomes with respect to the development & implementation & enforcement of environmental laws & regulations & policies.

No group of people should shoulder a disproportionate share of negative environmental impacts.

## What are tribal cultural resources?

Includes land, human remains, funerary objects, tribal cultural objects and items, medicinal plants, wildlife, sacred sites, and architecture.

-- Native American Graves Protection & Repatriation Act



Photo by Roseanne T. Orndorff

Darrell Martin. Assiniboinne, Gros Ventre & Cheyenne Tribes

***"Anything tied to the ongoing survival of our culture is a cultural resource."***

-- Scott Jones,  
Lower Brule Sioux Tribe



**WATER**

**Missouri River  
Great Falls, MT**

Diversion and contamination of river water causes destruction of medicinal plant and wildlife habitat.

Availability of water and water quality are essential for supporting tribal health, economy and cultural life.

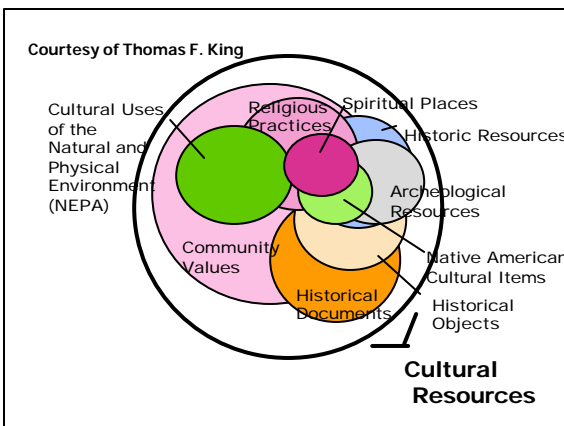




## “Cultural Resource Law”

- ❑ No explicitly titled body of “cultural resource” law
- ❑ Various legal authorities apply to various kinds of cultural resources -- e.g.:
  - ✓ Community values, use of natural resources
  - ✓ Historic properties, archeological sites
  - ✓ Spiritual places, religious beliefs and actions

Courtesy of Thomas F. King



## Authorities for Tribal Cultural Resource Protection



## National Environmental Policy Act (NEPA)

- ✓ assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings
- ✓ achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities
- ✓ preserve important historic, cultural, and natural aspects of our natural heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice. 42 U.S.C. § 4331(b)

## NEPA definition of “environment”

***“Human environment” shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment.***



## Why is EPA involved?

The **Clean Air Act, Section 309** requires the Administrator of the EPA to comment in writing upon the environmental impacts associated with major federal actions of other agencies.

## Isleta Pueblo

Do environmental laws address cultural resource issues?

The environmental issue is a very spiritual one and I think it takes the understanding and recognition that water and all natural resources are really spirits.

Verna Williamson  
Former Isleta Governor



## Isleta Pueblo

CWA § 518 authorizes EPA to treat Tribes as States, including in the issuance of Water Quality Standards (WQS)

Although the WQS apply only within the area of the Tribal Government's jurisdiction, EPA can require an upstream state not to interfere with attainment of the WQS.



## Isleta Pueblo

**Pueblo of Isleta Set WQS for:**

"Primary Contact Ceremonial Purposes Use"-- immersion and ingestion of Rio Grande's water

**City of Albuquerque sues EPA, alleging:**

- Tribe has no right to enforce
- Procedural violations
- Separation of Church and State

## Isleta Pueblo

### 10<sup>th</sup> Circuit Court of Appeals Holds

- No Procedural Violation
- EPA, not Isleta, may enforce against upstream permit holder
- No violation of Church and State in EPA approving WQS:
  - EPA's purpose in approving standard is related to water quality not religion

## Isleta Pueblo

[Our] perspective hasn't been brought forth before. I think that the EPA Officials who were at the table with us the day we brought this issue out were just flabbergasted? "What are you talking about, religious freedom?" What we're saying is if we can't drink the water we cannot complete our ceremonies because the water is not clean. And if we can't drink it because of all the toxins in it, then our religious freedom is being impinged upon. . . . And that is a very serious situation for Indian people.

Verna Williamson  
-Spirituality and the Native Earth

### Lake Sharp Drawdown

- Bad River
- Lake drawdown
- Flush sediment
- Exposure and looting of cultural resources and remains
- Destruction of remains through wave action

### Drawdown (con't)

- Potential mobilization of heavy metals in sediment
- Potential drinking water problems with tribal intakes
- Evaluation of impacts under NEPA
- NHPA
- Government to Government consultation

### Summary

- Not all cultural resource impacts are EJ impacts, but some are.
- Building tribal capacity and respect for tribal sovereignty is a means to achieve environmental justice.
- Strong regulatory approaches may create incentive for negotiated and collaborative outcomes.

### Acknowledgements

- Scott Jones, Lower Brule Sioux Tribe
- Thomas F. King, National Preservation Institute
- Roxanne T. Ornelas, Univ of Minnesota
- Daniel Gogal, Office of Environmental Justice

**Evaluation Summary**  
**River Systems Management Workshop**  
**November 4 - 6, 2003**

	Poor	Adequate	Good	Excellent
Rate the quality of information you received.			30	9
Rate how this workshop met your expectations.		3	28	8
<b>AGENDA</b>				
Selection of topics		2	27	10
Organization of lectures		8	22	10
Amount of time allowed for each topic	1	4	26	8
Opportunity to network with co-workers	1		11	28
Arrangement of meeting time (Tuesday afternoon to Thursday noon)	1	2	17	20
Length of meeting		3	24	11
<b>SPEAKERS</b>				
Audio-visual aides		12	18	10
Content of Presentations		6	24	10
Allowed group participation		6	25	9
Overall benefit of presentations		3	29	8
<b>POSTER SESSION</b>				
Content		6	21	12
Format		6	21	12
Time allowed		3	21	15
<b>BREAKOUT SESSIONS</b>				
Content		5	21	14
Format		7	19	14
Time allowed		5	20	15
<b>HOTEL ARRANGEMENTS</b>				
Adequacy of meeting facilities		1	15	23
Personal hotel accommodations and service		5	12	21

Quality of food, beverages and meal service		4	12	22
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**What aspect of the workshop did you like most and why?**

- All
- Lots of good information on a variety of subjects
- Hot topics, legal issues – relevant to the work that I am doing
- Opportunities to network and discuss projects and how others are working through conflicts/issues
- Breakout sessions – opportunity to discuss topics at length
- Sharing of information was excellent
- Exchange of info/meeting with colleagues
- The variety of topics – all regions well represented
- Interaction with others experiencing similar issues. Helps to see what others are up against and how it is addressed
- Working lunch
- Panel discussions
- Networking with people. The format of workshop was great; speakers for each topic were very diverse
- Breakout sessions because we got to pick specific topics of interest
- The poster session
- Breakout sessions – they were very instructive and informative
- The topics because they addressed present situation like drought and water conflicts
- Hot topics – good to hear about current issues at each Region. Also enjoyed the mix of academic and technical and the coordination with local university
- Understanding other district/regional water problems helps contextualize my own work
- Networking opportunities
- Case studies, conflict resolution presentations
- The variety and range of topics on river systems management
- Very well organized. Large screen in the meeting room was very nice
- Good diversification of speakers! Very good. I really enjoyed Bob Snow's, Megan Walline's, and Aaron Wolf's presentations
- Good updates on what is going on both in the west and the world. It was also interesting to hear the hot topics from each of the regions
- Ability to get together and discuss issues and successes
- Networking and breakout sessions
- Networking
- Breakouts allow for interaction of different regions and their concerns discussed in a session
- The breakout sessions and poster exhibits were the best part of the workshop
- Discussion by solicitors very good
- The optional tour is a good idea to allow people to see local facilities
- Hearing experiences from other Reclamation offices to compare roles and learn
- I especially liked the non-Reclamation and international case studies from Pete Loucks and Aaron Wolf.
- Aaron Wolf's talk during the general session and breakout
- Dr. Wolf's presentation Wednesday morning – it was a different perspective, yet it hit home with me
- Liked some of the speakers – Aaron Wolf, Pete Loucks. Also thought discussion on CA4.4 and MRG was good. Interesting to see what's going on elsewhere and how it could affect other regions.
- Excellent speakers and breakout moderators; great support by Marlene and Jeff
- Loucks & Wolf presentations; field trip

**What aspect of the workshop did you like least and why?**

- Mr. Rinne mentioned importance of hydropower in keynote speech. That was the last mention of

hydropower in the conference (no wonder WAPA was created!)

- Some of the breakout sessions were of limited interest to me, of course, I only attended those that did.
- Presentations (some) could have been more dynamic – more use of visuals, more dynamic speaking, etc.
- The discussions on law were too general
- Native American Affairs – least applicable to my field
- Short time slots for speakers
- Starting Tuesday afternoon and finishing at noon
- Didn't start the sessions on time
- Poster exhibits not applicable to what I do
- Better organization of some of the breakout sessions
- 30-minute breaks – need more breaks, shorter time frame
- Sometimes hard to hear. Every speaker should have a microphone and use it. Even in question/answer periods (it's the job of the moderator to insist on this). The air handler in the Arizona room was noisy enough that it was very hard to hear a lot of the discussion.
- One of the breakout sessions was more general (Loucks); the other one (Wolf), more specific. I liked them both, but specific information (if can be given) is more helpful, i.e., specifically learning about negotiating techniques, things I can use on a daily basis.
- Presentation on the Justice Department
- Time of year – consider holding the next one in early October – less going on for managers at that time.
- The presentations needed some work on visual aides, content was good
- Participation/attendance was down, probably in response to travel/budget restrictions
- The legal (general session 1) talks were rather long. I found it hard to stay focused without use of visual aides
- The emphasis on the history and background of some of the case studies in the Hot Topics session, legal issues, and ag vs. urban. Should have been more focused on lessons learned. The lessons learned section of these talks were often a short summary at the end.
- Wednesday seemed long with talks all day and including lunch
- Did not get much out of Department of Justice speaker
- Breakout room logistics – Idaho/Michigan
- Lack of restaurants within walking distance of hotel
- Occasional presentations without visuals or clear organization

#### **Which General Session was most beneficial to you and why?**

- Aaron Wolf session
- All were to a certain extent
- Hot topics, legal issues – relevant to the work that I am doing
- Discussions on solicitor and Department of Justice roles. Presentation by Aaron Wolf.
- Ag. vs. urban issues – interesting presentations
- Hot topics on Tuesday – I was not aware of most of these issues
- California 4.4 maf discussion. Very straight forward, easily understandable and informative
- Legal issues related to water use, although out issues are generally not this complex the same process seems to apply to all
- State vs. Ag – Aaron Wolf presentation. Challenged our assumptions about water conflict and very interesting
- Solicitors session was very informative. Hearing from solicitors on points of interest on litigation, consultation and interpretation on legal issues involved was very educational and informative
- Aaron Wolf's topics were very fresh and interesting. It's good to include speakers like him that are coming from an outside perspective
- Hot topics, got to hear about issues in other regions
- Hot topics in water management. Breakout sessions
- General session 1 – legal issues. The presentations increased my understanding of these current legal issues

facing Reclamation

- All sessions in general
- Legal issues – Bob Snow’s presentation on CA 4.4 was very informative
- Hot topics
- Collaboration – to see how others accomplish this task – Native American
- Legal issues. A better opportunity to see how the solicitors and Justice work together
- Updates from the regions, updates on legal challenges and general direction on water law. How to deal with others and achieve collaboration
- Session with Solicitors (Bob Snow and Megan Walline)
- General session 1 – legal issues. They covered the topics well.
- Need them all, well balanced.
- Office of Solicitors and Department of Justice. Interesting to hear their opinion/side of ESA issues
- The talk by Dick Wolfe was the most beneficial. He needed more time since he was not able to finish.
- Wednesday general session – understand how solicitors and Department of Justice work
- DOJ and office of solicitor because we finally got an understanding of what each does
- Bill Rinne’s keynote for overall Reclamation direction in river management and legal issues. Appreciated getting a better understanding of California’s 4.4 plan
- Hot topics, other regions have the same issues I have
- Really enjoyed Aaron Wolf and Pete Loucks
- Solicitors panel and hot topics
- Manager’s panel; current topics

**Which General Session was least beneficial to you and why?**

- Indian water issues, though interesting was not directly relevant to my work
- Native American issues – presentations were difficult for me to follow
- OCAP – no background info provided, no description of overall picture. I was quickly lost.
- Native American affairs – least applicable to my field
- Ag vs. urban uses
- Water law issues
- Native American water issues – this is not a concern in our area
- Native American water issues too generic – specific issues/conflicts not discussed. However, I also recently attended a Native American conference
- Native American issues
- Modeling – not easy to understand
- I believe each session had something to offer and I learned something from each session
- Ag vs. urban, needed more pizzaz – and case studies. Probably an economist would have benefited the session too
- Session 1 – after Bob Snow’s talk I found it hard to stay focused – legal overload
- Session 2 didn’t seem to really pinpoint what of the ag vs. urban uses have changed and how that affects Reclamation
- Ag vs. urban uses (minus Aaron Wolf presentation). I feel the first speakers needed to focus more on broader lessons learned rather than case specific details
- Ag vs. urban, just the portion from the State Engineer’s office didn’t apply I think
- DOJ
- Native American Water issues; except for Chris Kenney, did not seem particularly focused or easily applied

**What topics would you like to see discussed in future breakout sessions?**

- First meeting
- Technical issues associated with water transfer

- Communicating scientific info/results of studies to users/public
- New gaging methods; databases; data needs
- Research efforts and modeling
- Continued update of the Hot Topics – CA 4.4 maf, Klamath, Indian water rights, CBT/Green Mountain reservoir
- Provide more technical sharing of new procedures/methods
- Water law demonstrated on actual operation – applied operation from case study
- More technical issues dealing with water operations and hydropower
- It will depend on water conditions and conflicts at the time of next workshop
- Technical modeling in other regions
- Integration of water and natural resources management
- More NEPA, how best to deal with and more on NA consultation, ITA's, and environment justice
- A session which tracks a law suit from first conflict through resolution. Who is first involved, what capacity, who has what responsibility
- How to do proper documentation – what is required, what are the basic requirements, what does this entail. With the ever increased legal challenges, we need to do a better job
- More social science with group participation (negotiating, conflict resolution, etc.)
- I think all break out sessions were good
- Climate/weather/hydrology/advances in hydraulics/sediment transport. Showcase Denver Office capabilities for RO's and AO's
- Data collection and needs
- More university PhD's talking about current research related and applied to water management and issues. I found Dr. Loucks and Dr. Wolf's talks interesting
- Perhaps a short session on innovative water conservation efforts going on in the west
- Have somebody from DOJ or Office of Solicitor provide information on steps to take when legal questions arise and who to contact
- Weather and climate forecasting; other additional non-Reclamation case studies and lessons learned; irrigation efficiencies, what works, what does not
- Some asked if we have a call for papers
- Water 2025 – a look back at accomplishments in '04 – where we go from “here” and lessons learned; groundwater/surface water management as it affects river management
- Case studies of river management in specific, difficult years

**What suggestions do you have for the next workshop, i.e., agenda, format, speakers, breakout topics, etc.?**

- None other than to send presenters to a PowerPoint 101 course so that the presentations are visible and contain useful information
- November is not a good time for conferences. Have them at times the length of day is longer for field trips at the end of the day
- Some case studies of completed or ongoing projects that require resolving competing uses for water
- I thought the breakout sessions were well designed. However, some general questions to start may have been good starters for discussions and would have helped to direct the discussion
- Keep general information sessions as part of the workshop. I found that the presentation by Aaron Wolf both enlightening and beneficial
- Think that it is good idea to skip a year. Feel that having workshop every 2-3 years helps in keeping workshop and participants enthusiastic
- Continue speakers from outside BOR. Speakers that challenge us – topics – proactive approaches to avoiding crisis management
- What happens with our identified needs/concern relating to tools of the trade – models, etc. Forward recommendation to
- A panel of solicitors for one of the breakout sessions
- I would suggest that a 2-day workshop, running Tuesday morning to Wednesday evening would shorten the



time of travel, i.e., Tuesday morning and Thursday afternoon were idle periods

- Bring some vendors; computer technology, remote sensing, communication, etc.
- Should keep once per year, but could alternate between technical and policy. A workshop dedicated to technical modeling and operations to see how other regions do day-to-day business
- Efforts in developing and sharing monitoring functions and data collection and dissemination
- In Aaron's Wolf's presentation, he has a quote, "The likelihood of conflict rises as the rate of change within the basin exceeds the institutional capacity to absorb that change." It would be interesting to discuss Reclamation's institutional capacity to absorb that change. Also to address what we as an agency can be doing differently, what works, what does not. How can we do better? Need to focus on planning, consistency, data collection, good documentation. This would be an excellent training session – learning negotiation techniques
- Perhaps a motivational speaker during the lunch session just to break up the issue oriented stuff a little
- I think this workshop was about the right amount of time. A more diverse background of speakers would be beneficial
- Good format; more university PhD's, good breakout topics
- Partnership examples; include some water conservation discussions
- Maybe an International water management systems workshop? It seems that if it was separate from this that might be best, but there could be a lot to learn from other countries.
- Have speakers from Pueblos and Tribes for outside perspective; next workshop 2 years down the road could have a general session on implementing water 2025; a keynote speaker from DOI in DC could give some perspective on DOI direction for river management, Reclamation's role and how the DOI sister agencies work together, BOR FWS, BIA, etc.
- I would like to see 2 full days and a half day to extend conference
- Consider an evening ice breaker no-host bar get together the night before the formal conference begins. This would help folks loosen up, mingle, network – could be with poster session

**General comments that you have that would help improve this workshop:**

- Good workshop. Thank you for training and support
- I thought the breaks were longer than needed. I could go back to my room and take a nap between sessions
- Very informative
- Found that a lot of the discussion was similar to that of the 2002 workshop – general sessions being the exception
- Encourage manager panelists to put more thought, time into offering future directions, innovations (as Bill McDonald and Connie Rupp did)
- A second keynote speaker that challenges us – like Marc Reisner did or TU guy
- Excellent information sharing
- More comfortable chairs
- I would prefer a hotel that has a more reasonable cost to the general business amenities, such as internet connectivity, business breakfasts, etc. Standard items at most business hotels these days.
- In general I think this is a great workshop. It will be a challenge to try to improve it. Looking forward for next year's.
- Overall, very good workshop. Could be beneficial to develop a list of key issues in regions to present to Reclamation management
- TSC did a great job on pulling this all together
- I have no real complaints. I enjoyed all the sessions. It is good to get out of the office and network with other colleagues. Thank you for the excellent workshop.
- Encourage and facilitate more audience participation
- A session where modelers of water systems come together to share their experiences and learning curves would assist the technical people in understanding their system and may give them ideas to help them solve their problems
- Need to schedule early in order to budget. If current budget/travel limits persist, then consider less frequent

workshops. River systems management is central to Reclamation's mission and this workshop is a high priority for me

- The format was great in Hot Topics, poster session, breakouts. I would suggest the poster session be enlarged. BOR has funded many research projects around the Western US. Invite these students and research groups to report on their current research projects with posters. Very well done
- Aaron Wolf did a good job of really providing us tools for water conflict resolution
- Moderators did a great job of keeping on time. Good job, I enjoyed the conference
- Have it earlier in the year. It's dark at 5:00 when conference ends, no time for field trips or sight seeing
- Meeting room cold – easily changed; recommend a little more down time at lunch. Shorten speakers so participants get a break. Folks were pretty worn out by 1:30 breakout.
- Thanks for your hard work in putting this on

## River Systems Management Workshop, Ft. Collins CO - November 2003

Last Name	First Name	Region	Organization	Title	Field Trip	Email	Phone Number	Fax Number	Address	City	St	Zip
Abart	Ellen	Technical Ser	Bureau of Reclamation	Civil Engineer	Maybe	<a href="mailto:eabart@do.usbr.gov">eabart@do.usbr.gov</a>	303-445-2247	303-445-6329	PO Box 25007, D-8230	Denver	CO	80225
Anderson	Curtis	Great Plains R	Bureau of Reclamation	Civil Engineer	Yes	<a href="mailto:canderson@gp.usbr.gov">canderson@gp.usbr.gov</a>	605-394-9757	605-394-9346	515 9th Street, Room 101	Rapid City	SD	57701
Aycock	Gordon	Great Plains R	Bureau of Reclamation	Hydraulic Engineer	Maybe	<a href="mailto:gaycock@gp.usbr.gov">gaycock@gp.usbr.gov</a>	406-247-7756	406-247-7793	316 N. 26th Street	Billings	MT	59107
Barnett	Karen	Upper Colorad	Bureau of Reclamation	Wildlife Biologist	Maybe	<a href="mailto:kbarnett@uc.usbr.gov">kbarnett@uc.usbr.gov</a>	801-524-3871	801-524-3858	125 South State Street, Room 6107	Salt Lake City	UT	84138
Beek	Jari	Great Plains R	Bureau of Reclamation	Great Plains Deputy Regional Director	Yes	<a href="mailto:jbeek@gp.usbr.gov">jbeek@gp.usbr.gov</a>	406-247-7603	406-247-7604	PO Box 36900	Billings	MT	59107
Bender	Merlynn	Technical Ser	Bureau of Reclamation	Water Quality Modeler	Maybe	<a href="mailto:mbender@do.usbr.gov">mbender@do.usbr.gov</a>	303-445-2460	303-445-6351	PO Box 25007, D-8570	Denver	CO	80225
Berkley	Jim		Environmental Protection Agency, Region 8	Missouri River Basin Coordinator	Yes	<a href="mailto:berkley.jim@epamail.epa.gov">berkley.jim@epamail.epa.gov</a>	303-312-7102		999 18th Street, Suite 300	Denver	CO	80202
Beus	Michael	Pacific Northw	Bureau of Reclamation	Water Operations Manager, Snake River Area Office	Yes	<a href="mailto:mbeus@pn.usbr.gov">mbeus@pn.usbr.gov</a>	208-678-0461 x27	208-678-7197	1359 Hansen Avenue	Burley	ID	83318
Brekke	Levi	Mid-Pacific Re	Bureau of Reclamation	Water Resources Modeler	Yes	<a href="mailto:lbrekke@mp.usbr.gov">lbrekke@mp.usbr.gov</a>	916-978-5185	916-978-5094	2800 Cottage Way, MP-700	Sacramento	CA	95825
Brendecke	Chuck		Hydrosphere	President	No	<a href="mailto:cmb@hydrosphere.com">cmb@hydrosphere.com</a>	303-443-7839	303-442-0616	1002 Walnut Street, #200	Boulder	CO	80302
Carra	Marsha	Upper Colorad	Bureau of Reclamation	Environmental Protection Specialist	Maybe	<a href="mailto:mcarra@uc.usbr.gov">mcarra@uc.usbr.gov</a>	505-462-3602	505-462-3797	555 Broadway NE Suite 100	Albuquerque	NM	87102
Clayton	Rick	Upper Colorad	Bureau of Reclamation	Hydraulic Engineer	Yes	<a href="mailto:rclayton@uc.usbr.gov">rclayton@uc.usbr.gov</a>	801-524-3710	801-524-3847	125 S. State Street, Room 6107, UC-435	Salt Lake City	UT	84138
Collins	Michael	Lower Colorad	Bureau of Reclamation	Deputy Area Manager, Yuma Area Office	No	<a href="mailto:mcollins@lc.usbr.gov">mcollins@lc.usbr.gov</a>	928-343-8125	928-343-8132	7301 Calle Aqua Salada	Yuma	AZ	85364
Coors	Shane	Upper Colorad	Bureau of Reclamation	Student Intern	No	<a href="mailto:shanecoors@hotmail.com">shanecoors@hotmail.com</a>	979-694-2338	979-696-2685	2701 Longmire #1024	College Station	TX	77845
Cowan	Dillon		Colorado State University	Student, Civil Engineering	Maybe	<a href="mailto:dilloncowan@hotmail.com">dilloncowan@hotmail.com</a>	720-289-7535		630 Miller Drive	Fort Collins	CO	80521
Cowan	Mike		Western Area Power Administration	Technical Services Manager	No	<a href="mailto:cowan@wapa.gov">cowan@wapa.gov</a>	720-962-7245	720-962-7427	PO Box 281213	Lakewood	CO	80228
Crawford	Toby	Mid-Pacific Re	Bureau of Reclamation	Water Resources Modeler	Yes	<a href="mailto:tcrawford@mp.usbr.gov">tcrawford@mp.usbr.gov</a>	916-978-5080	916-978-5094	2800 Cottage Way, MP-700	Sacramento	CA	95825
Crookston	Peter	Upper Colorad	Bureau of Reclamation	Fish & Wildlife Biologist	Yes	<a href="mailto:pcrookston@uc.usbr.gov">pcrookston@uc.usbr.gov</a>	801-379-1152	801-379-1159	302 East 1860 South	Provo	UT	84606
Cutler	Christopher	Upper Colorad	Bureau of Reclamation			<a href="mailto:ccutler@uc.usbr.gov">ccutler@uc.usbr.gov</a>	801-524-3698		125 So State Street	Salt Lake City	UT	84138
Dubois	Jim		Department of Justice	Attorney, General Litigation Section		<a href="mailto:james.dubois@usdog.gov">james.dubois@usdog.gov</a>			999 18th Street, Suite 945 North Tower	Denver	CO	80202
Eggers	Ron	Pacific Northw	Bureau of Reclamation	Area Manager, Lower Columbia Area Office	No	<a href="mailto:reggers@pn.usbr.gov">reggers@pn.usbr.gov</a>	503-872-2795	503-872-2797	825 NE Multnomah, #1110	Portland	OR	97232
Engelbrite	P. Nannette	Mid-Pacific Re	Bureau of Reclamation	Projects Branch Chief, Division of Planning	Yes	<a href="mailto:nengelbrite@mp.usbr.gov">nengelbrite@mp.usbr.gov</a>	916-978-5073	916-978-5094	2800 Cottage Way	Sacramento	CA	95825

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Last Name	First Name	Region	Organization	Title	Field Trip	Email	Phone Number	Fax Number	Address	City	St	Zip
Fenolio	Joel	Mid-Pacific Re	Bureau of Reclamation		Yes	<a href="mailto:jfenolio@mp.usbr.gov">jfenolio@mp.usbr.gov</a>	916-979-2139	916-979-2494	3310 El Camino, Suite 300	Sacramento	CA	95825
Flug	Marshall		US Geological Survey	Research Hydrologist	No	<a href="mailto:marshall_flug@usgs.gov">marshall_flug@usgs.gov</a>	970-226-9391	970-226-9452	2150 Centre Avenue, Bldg. C	Fort Collins	CO	80526
Fodrea	Jim	Pacific Northw	Bureau of Reclamation	Acting Manager, Columbia/Snake Salmon Recovery Office	Maybe	<a href="mailto:jfodrea@pn.usbr.gov">jfodrea@pn.usbr.gov</a>	208-378-5392	208-378-5191	1150 N. Curtis Road, Suite 100	Boise	ID	83706
Fontane	Darrell		Colorado State University	Professor	No	<a href="mailto:fontane@engr.colostate.edu">fontane@engr.colostate.edu</a>	970-491-5248		Civil Engineering Department	Fort Collins	CO	80523
Frevert	Don	Technical Ser	Bureau of Reclamation	Hydraulic Engineer	Yes	<a href="mailto:dfrevert@do.usbr.gov">dfrevert@do.usbr.gov</a>	303-445-2473	303-445-6351	PO Box 25007	Denver	CO	80225
Fujitani	Paul	Mid-Pacific Re	Bureau of Reclamation	Chief, Water Operations Division	Maybe	<a href="mailto:pfujitani@mp.usbr.gov">pfujitani@mp.usbr.gov</a>	916-979-2197	916-979-2494	3310 El Camino	Sacramento	CA	95821
Fulp	Terry	Lower Colorad	Bureau of Reclamation	Manager, River Operations	Yes	<a href="mailto:tfulp@lc.usbr.gov">tfulp@lc.usbr.gov</a>	702-293-8190	702-293-8042	PO Box 61470	Boulder City	NV	89006
Gabaldon	Mike	Washington D	Bureau of Reclamation	Director, Policy, Mgmt, and Technical Services		<a href="mailto:mgabaldon@usbr.gov">mgabaldon@usbr.gov</a>	202-513-0618		1849 C Street NW	Washington	DC	20240
Gage	John	Great Plains R	Bureau of Reclamation	Water Resource Planner/Geololgist	Yes	<a href="mailto:jgage@gp.usbr.gov">jgage@gp.usbr.gov</a>	405-606-2911	405-606-2927	4149 Highline Blvd, Suite 200	Oklahoma City	OK	73108
Giovando	Jeremy	Great Plains R	Bureau of Reclamation	Hydraulic Engineer	Yes	<a href="mailto:jgiovando@gp.usbr.gov">jgiovando@gp.usbr.gov</a>	406-247-7320	406-247-7338	PO Box 30137	Billings	MT	59107
Gjerde	Kip	Great Plains R	Bureau of Reclamation	Regional Planning Coordinator	Yes	<a href="mailto:jgjerde@gp.usbr.gov">jgjerde@gp.usbr.gov</a>	406-247-7750	406-247-7680	PO Box 36900	Billings	MT	59107
Gomoll	Terry	Great Plains R	Bureau of Reclamation	Repayment Specialist	No	<a href="mailto:tgomoll@gp.usbr.gov">tgomoll@gp.usbr.gov</a>	970-962-4352	970-962-3212	11056 West County Road 18E	Loveland	CO	80537
Gourley	James	Upper Colorad	Bureau of Reclamation	Operations Supervisor	No	<a href="mailto:lgourley@uc.usbr.gov">lgourley@uc.usbr.gov</a>	928-645-0470	928-645-0410	PO Box 1477	Page	AZ	86040
Grajeda	Jesus Javier	Upper Colorad	Bureau of Reclamation	Hydrological Engineer	No	<a href="mailto:jgrajeda@uc.usbr.gov">jgrajeda@uc.usbr.gov</a>	915-534-6319	915-534-6299	700 East San Antonio Avenue, Suite 710	El Paso	TX	79901
Grigg	Neil S.		Colorado State University	Professor	No	<a href="mailto:neil.grigg@colostate.edu">neil.grigg@colostate.edu</a>	970-491-3369	970-491-7727	Civil Engineering Department	Fort Collins	CO	80523
Hannon	John	Mid-Pacific Re	Bureau of Reclamation	Fisheries Biologist	Maybe	<a href="mailto:jhannon@mp.usbr.gov">jhannon@mp.usbr.gov</a>	916-978-5524	916-978-5055	2800 Cottage Way, MP-150	Sacramento	CA	95825
Hunter	Steven	Technical Ser	Bureau of Reclamation	Research Meteorologist	Yes	<a href="mailto:smhunter@do.usbr.gov">smhunter@do.usbr.gov</a>	303-445-2478	303-445-6351	PO Box 25007	Denver	CO	80225
Hvinden	Steve	Lower Colorad	Bureau of Reclamation	Water Admin Manager	Maybe	<a href="mailto:shvinden@lc.usbr.gov">shvinden@lc.usbr.gov</a>	702-293-8536	702-293-8042	PO Box 61470	Boulder City	NV	89006
Jansen-Lute	Chris	Pacific Northw	Bureau of Reclamation	Acting Program Manager, Water Resources Management	No	<a href="mailto:cjansen@pn.usbr.gov">cjansen@pn.usbr.gov</a>	208-378-5319	208-378-5305	1150 North Curtis Road	Boise	ID	83706
Johnson	Marlene	Technical Ser	Bureau of Reclamation	Assistant Resource Manager	Maybe	<a href="mailto:mjohnson@do.usbr.gov">mjohnson@do.usbr.gov</a>	303-445-2117	303-445-6780	PO Box 25007	Denver	CO	80225
Johnson	Robert W.	Lower Colorad	Bureau of Reclamation	Lower Colorado Regional Director		<a href="mailto:bjohnson@lc.usbr.gov">bjohnson@lc.usbr.gov</a>	702-293-8411	702-293-8156	PO Box 61470	Boulder City	NV	89005

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Last Name	First Name	Region	Organization	Title	Field Trip	Email	Phone Number	Fax Number	Address	City	St	Zip
Kenney	Chris	Washington D	Bureau of Reclamation	Director, Native American Affairs	Maybe	<a href="mailto:ckenney@usbr.gov">ckenney@usbr.gov</a>	202-513-0625	202-513-0311	1849 C Street NW	Washington	DC	20240
King	David	Technical Ser	Bureau of Reclamation	Hydraulic Engineer		<a href="mailto:dking@do.usbr.gov">dking@do.usbr.gov</a>	303-445-2471	303-445-6351	PO Box 25007, D-8510	Denver	CO	80225
Klawon	Jeanne	Technical Ser	Bureau of Reclamation	Geomorphologist	Yes	<a href="mailto:klawon@do.usbr.gov">klawon@do.usbr.gov</a>	303-445-3164	303-445-6351	PO Box 25007, D-8530	Denver	CO	80225
Knight	Erik	Upper Colorad	Bureau of Reclamation	Hydrologist	Maybe	<a href="mailto:eknight@uc.usbr.gov">eknight@uc.usbr.gov</a>	970-248-0629	970-248-0601	2764 Compass Drive, Suite 106	Grand Junction	CO	81506
Kouma	Ed	Great Plains R	Bureau of Reclamation	Supervisory Hydraulic Engineer	No	<a href="mailto:ekouma@gp.usbr.gov">ekouma@gp.usbr.gov</a>	307-261-5633	307-261-5683	PO Box 1630	Mills	WY	82644
Krause	Andreas	Mid-Pacific Re	Bureau of Reclamation	Hydraulic Engineer	Yes	<a href="mailto:akrause@mp.usbr.gov">akrause@mp.usbr.gov</a>	530-623-1800	530-623-5944	1313 South Main Street	Weaverville	CA	96093
Kube	Michael	Great Plains R	Bureau of Reclamation	Civil Engineer	Maybe	<a href="mailto:mkube@gp.usbr.gov">mkube@gp.usbr.gov</a>	308-389-4622	308-389-4780	203 West Second Street	Grand Island	NE	68801
Labadie	John		Colorado State University	Professor	No	<a href="mailto:labadie@engr.colostate.edu">labadie@engr.colostate.edu</a>	970-491-6898	970-491-7727	Department of Civil Engineering, Colorado State University	Fort Collins	CO	80523
Loftin	Samuel D.		Western Area Power Administration	General Engineer	Yes	<a href="mailto:loftin@wapa.gov">loftin@wapa.gov</a>	801-524-6381	801-524-5017	PO Box 11606	Salt Lake City	UT	84147
Lora	Carlos	Great Plains R	Bureau of Reclamation	Hydraulic Engineer		<a href="mailto:clora@gp.usbr.gov">clora@gp.usbr.gov</a>	970-962-4309	970-962-3212	11056 West County Road 18E	Loveland	CO	80537
Loucks	Daniel P.		Cornell University	Professor	No	<a href="mailto:DPL3@cornell.edu">DPL3@cornell.edu</a>	607-255-4896	607-255-9004	Hollister Hall	Ithaca	NY	14853
Lubas-Williams	Ann	Mid-Pacific Re	Bureau of Reclamation	Hydrologist	Maybe	<a href="mailto:alubaswilliams@mp.usbr.gov">alubaswilliams@mp.usbr.gov</a>	916-979-2068	916-979-2494	3310 El Camino, Suite 300	Sacramento	CA	95821
Luce	William	Mid-Pacific Re	Bureau of Reclamation	Area Manager, South-Central CA Area Office	Maybe	<a href="mailto:wluce@mp.usbr.gov">wluce@mp.usbr.gov</a>	559-487-5116	559-487-5397	1243 N Street	Fresno	CA	93721
Lucero	Jeffrey	Great Plains R	Bureau of Reclamation	Hydrologist	Maybe	<a href="mailto:jlucero@gp.usbr.gov">jlucero@gp.usbr.gov</a>	406-247-7751	406-247-7680	PO Box 36900	Billings	MT	59107
Magee	Tim		University of Colorado	Operations Research Analyst	No	<a href="mailto:magee@colorado.edu">magee@colorado.edu</a>	303-492-2657	303-492-1347	Center for Advanced Decision Support for Water and Environmental Systems, Campus Box 421	Boulder	CO	80309
Martella	Susan	Technical Ser	Bureau of Reclamation	Civil Engineering Technician	No	<a href="mailto:smartella@do.usbr.gov">smartella@do.usbr.gov</a>	303-445-2257	303-445-6329	PO Box 25007, D-8230	Denver	CO	80225
McDonald	J. William	Pacific Northw	Bureau of Reclamation	Pacific Northwest Regional Director	Maybe	<a href="mailto:jmcdonald@pn.usbr.gov">jmcdonald@pn.usbr.gov</a>	208-378-5012	208-378-5019	1150 N. Curtis Road	Boise	ID	83706
Mellema	Mary	Pacific Northw	Bureau of Reclamation	Hydrologist	Maybe	<a href="mailto:mmellema@pn.usbr.gov">mmellema@pn.usbr.gov</a>	208-378-5118	208-378-5307	1150 N. Curtis Road	Boise	ID	83706
Miller	Tim	Pacific Northw	Bureau of Reclamation	Hydrologist	Yes	<a href="mailto:twmiller@pn.usbr.gov">twmiller@pn.usbr.gov</a>	208-678-0461 ext 25	208-678-4321	1359 Hansen Avenue	Burley	ID	83318
Morstein-Marx	Tom	Mid-Pacific Re	Bureau of Reclamation	Hydraulic Engineer	Yes	<a href="mailto:tmorsteinmarx@mp.usbr.gov">tmorsteinmarx@mp.usbr.gov</a>	916-979-2196		3310 El Camino, Suite 300	Sacramento	CA	95821
Mull	Ty	Technical Ser	Bureau of Reclamation	Hydraulic Engineer	Yes	<a href="mailto:tmull@do.usbr.gov">tmull@do.usbr.gov</a>	303-445-2494	303-445-6351	PO Box 25007, D-8520	Denver	CO	80225
Nelson	Kirk	Mid-Pacific Re	Bureau of Reclamation	Hydraulic Engineer	Maybe	<a href="mailto:knelson@mp.usbr.gov">knelson@mp.usbr.gov</a>	916-978-5066	916-978-5094	2800 Cottage Way, Room W-2830	Sacramento	CA	95825
Nettleton	Jeffrey	Great Plains R	Bureau of Reclamation	Rapid City Field Office Manager	Maybe	<a href="mailto:jnettleton@gp.usbr.gov">jnettleton@gp.usbr.gov</a>	605-394-9757		515 Ninth Street, Room 101	Rapid City	SD	57701

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Last Name	First Name	Region	Organization	Title	Field Trip	Email	Phone Number	Fax Number	Address	City	St	Zip
O'Callaghan	John	Pacific Northw	Bureau of Reclamation	Hydraulic Engineer	Yes	<a href="mailto:jocallaghan@pn.usbr.gov">jocallaghan@pn.usbr.gov</a>	509-754-0244	509-754-0239	PO Box 815	Ephrata	WA	98823
Ore	Fred	Great Plains R	Bureau of Reclamation	Area Manager, Nebraska Kansas Area Office	Maybe	<a href="mailto:fore@gp.usbr.gov">fore@gp.usbr.gov</a>	308-389-4622	308-389-4780	203 West Second Street	Grand Island	NE	68801
Parker	Nancy	Technical Ser	Bureau of Reclamation	River Systems Modeler	Yes	<a href="mailto:nparker@do.usbr.gov">nparker@do.usbr.gov</a>	303-445-2532	303-445-6351	PO Box 25007	Denver	CO	80225
Parr	Kenneth	Mid-Pacific Re	Bureau of Reclamation	Natural Resource Specialist		<a href="mailto:kparr@mp.usbr.gov">kparr@mp.usbr.gov</a>	775-884-8356	775-882-7542	705 N. Plaza St, Room 320	Carson City	NV	89701
Patton	Thomas	Mid-Pacific Re	Bureau of Reclamation	Hydraulic Engineer	Yes	<a href="mailto:tpatton@mp.usbr.gov">tpatton@mp.usbr.gov</a>	916-979-2185	916-979-2494	3310 El Camino Avenue, Suite 300	Sacramento	CA	95821
Person	Brian	Great Plains R	Bureau of Reclamation	Area Manager, Eastern Colorado Area Office	No	<a href="mailto:bperson@gp.usbr.gov">bperson@gp.usbr.gov</a>	970-962-4300	970-663-3212	11056 West County Road 18E	Loveland	CO	80537
Phillips	Mark	Great Plains R	Bureau of Reclamation	Geologist	Maybe	<a href="mailto:mphillips@gp.usbr.gov">mphillips@gp.usbr.gov</a>	406-247-7743	406-247-7680	PO Box 36900	Billings	MT	59101
Prairie	James	Upper Colorad	Bureau of Reclamation	Hydraulic Engineer	Maybe	<a href="mailto:jprairie@uc.usbr.gov">jprairie@uc.usbr.gov</a>	303-492-8572	801-524-3187	125 South State Street, Room 6107	Salt Lake City	UT	84138
Relf	Michael	Pacific Northw	Bureau of Reclamation	Activity Manager	Yes	<a href="mailto:mrelf@pn.usbr.gov">mrelf@pn.usbr.gov</a>	208-378-5106	208-378-5102	1150 N. Curtis Road, Suite 100	Boise	ID	83706
Renning	John	Mid-Pacific Re	Bureau of Reclamation	Regional Water Rights Supervisor	Yes	<a href="mailto:jrenning@mp.usbr.gov">jrenning@mp.usbr.gov</a>	916-978-5295	916-978-5292	2800 Cottage Way, MP-440	Sacramento	CA	95825
Rieker	Jeffrey	Technical Ser	Bureau of Reclamation	Hydraulic Engineer	Maybe	<a href="mailto:jrieker@do.usbr.gov">jrieker@do.usbr.gov</a>	303-445-2484	303-445-6351	PO Box 25007, D-8510	Denver	CO	80225
Rinne	William E.	Washington D	Bureau of Reclamation	Deputy Commissioner Operations	Maybe	<a href="mailto:wrinne@lc.usbr.gov">wrinne@lc.usbr.gov</a>	202-513-0615	202-513-0312	1849 C Street NW	Washington	DC	20240
Rocha	Miguel	Upper Colorad	Bureau of Reclamation	Albuquerque Area Office		<a href="mailto:mrocha@uc.usbr.gov">mrocha@uc.usbr.gov</a>	505-462-3588		555 Broadway NE Suite 100	Albuquerque	NM	87102
Ross	Garret	Upper Colorad	Bureau of Reclamation	Hydraulic Engineer	Maybe	<a href="mailto:gross@uc.usbr.gov">gross@uc.usbr.gov</a>	505-462-3580	505-462-3797	555 Broadway NE Suite 100	Albuquerque	NM	87102
Rupp	Connie	Upper Colorad	Bureau of Reclamation	Assistant Regional Director	No	<a href="mailto:crupp@uc.usbr.gov">crupp@uc.usbr.gov</a>	801-524-3604	801-524-3855	125 South State Street, Room 6107	Salt Lake City	UT	84138
Ryan	Tom	Upper Colorad	Bureau of Reclamation	Hydraulic Engineer	No	<a href="mailto:tryan@uc.usbr.gov">tryan@uc.usbr.gov</a>	801-524-3732	801-524-5499	125 S. State Street	Salt Lake City	UT	84138
Salas	Jose D		Colorado State University	Professor		<a href="mailto:jsalas@engr.colostate.edu">jsalas@engr.colostate.edu</a>	970-491-6057	970-491-7727	Department of Civil Engineering, Colorado State University	Ft. Collins	CO	80523
Schleusner	Douglas	Mid-Pacific Re	Bureau of Reclamation	Executive Director	Maybe	<a href="mailto:dschleusner@mp.usbr.gov">dschleusner@mp.usbr.gov</a>	530-623-1800	530-623-5944	1313 South Main Street	Weaverville	CA	96093
Setzer	Steve		University of Colorado	CADSWES	No				Center for Advanced Decision Support for Water and Environmental Systems, Campus Box 421	Boulder	CO	80309
Simons	John	Upper Colorad	Bureau of Reclamation	Hydrologist	Maybe	<a href="mailto:jsimons@uc.usbr.gov">jsimons@uc.usbr.gov</a>	970-385-6571		835 East 2nd Avenue, Suite 400	Durango	CO	81301
Slavin	Tracy	Mid-Pacific Re	Bureau of Reclamation	Chief, Regional Resources	Maybe	<a href="mailto:tslavin@mp.usbr.gov">tslavin@mp.usbr.gov</a>	916-978-5202	916-978-5290	2800 Cottage Way, MP-400	Sacramento	CA	95825

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Last Name	First Name	Region	Organization	Title	Field Trip	Email	Phone Number	Fax Number	Address	City	St	Zip
Smith	Russell	Mid-Pacific Re	Bureau of Reclamation	Division Chief, Environmental and Natural Resources	No	<a href="mailto:rpsmith@mp.usbr.gov">rpsmith@mp.usbr.gov</a>	530-275-1554	530-275-2441	NCAO, 16349 Shasta Dam Boulevard	Shasta Lake	CA	96019
Snow	Bob	Washington D	Office of the Solicitor	Attorney			202-208-4379	202-219-1792	SOL - 6424, MS6412 MIB, 1849 C Street NW	Washington	DC	20240
Sonnichsen	Roger	Pacific Northw	Bureau of Reclamation	Hydraulic Engineer	Yes	<a href="mailto:rsonnichsen@pn.usbr.gov">rsonnichsen@pn.usbr.gov</a>	509-754-0260	509-754-0239	PO Box 815	Ephrata	WA	98823
Stillwater	Leslie	Pacific Northw	Bureau of Reclamation	Hydraulic Engineer	No	<a href="mailto:lstillwater@pn.usbr.gov">lstillwater@pn.usbr.gov</a>	208-378-5202		1150 N. Curtis Road	Boise	ID	83706
Stroup	Duane	Technical Ser	Bureau of Reclamation	Hydraulic Engineer	Yes	<a href="mailto:dstroup@do.usbr.gov">dstroup@do.usbr.gov</a>	303-445-2104		PO Box 25007, D-8520	Denver	CO	80225
Thayer	Ruth M.	Lower Colorad	Bureau of Reclamation	Manager, Water Conservation and Accounting Group	No	<a href="mailto:rthayer@lc.usbr.gov">rthayer@lc.usbr.gov</a>	702-293-8426	702-293-8042	PO Box 61470	Boulder City	NV	89006
Thomasson	Ronald R.	Great Plains R	Bureau of Reclamation	Hydraulic Engineer	No	<a href="mailto:rthomasson@gp.usbr.gov">rthomasson@gp.usbr.gov</a>	970-962-4313	970-962-3212	11056 West County Road 18E	Loveland	CO	80537
Tully	William D.	Great Plains R	Bureau of Reclamation	Environmental Specialist	No	<a href="mailto:wtully@gp.usbr.gov">wtully@gp.usbr.gov</a>	970-962-4368	970-962-3212	11056 West County Road 18E	Loveland	CO	80537
Umbreit	Nancy	Upper Colorad	Bureau of Reclamation	Biologist/NEPA Team Lead	No	<a href="mailto:numbreit@uc.usbr.gov">numbreit@uc.usbr.gov</a>	505-462-3599	505-462-3797	555 Broadway NE Suite 100	Albuquerque	NM	87102
Walline	Megan	Washington D	Office of the Solicitor	Attorney	No		202-208-4583	202-219-1792	1849 C Street NW, MS 6557	Washington	DC	20240
Walp	John	Technical Ser	Bureau of Reclamation	Mechanican Engineer	No	<a href="mailto:twalp@do.usbr.gov">twalp@do.usbr.gov</a>	303-445-2871	303-445-6354	PO Box 25007	Denver	CO	80225
Ward	Robert		Colorado State University	Director, Colorado Water Resosurces Research Institute	No	<a href="mailto:robert.ward@colostate.edu">robert.ward@colostate.edu</a>	970-491-6308		Colorado Water Resources Research Institute	Fort Collins	CO	80523
Wiedmeier	Dawn	Great Plains R	Bureau of Reclamation	Deputy Area Manager, Eastern Colorado Area Office	No	<a href="mailto:dwiedmeier@gp.usbr.gov">dwiedmeier@gp.usbr.gov</a>	970-962-4343	970-663-3212	11056 West County Road 18E	Loveland	CO	80537
Wilber	James	Upper Colorad	Bureau of Reclamation	Manager, Collaborative Program	No	<a href="mailto:jwilber@uc.usbr.gov">jwilber@uc.usbr.gov</a>	505-462-3548	505-462-3780	555 Broadway NE Suite 100	Albuquerque	NM	87102
Williams	Bruce	Lower Colorad	Bureau of Reclamation	Hydraulic Engineer	Yes	<a href="mailto:bwilliams@lc.usbr.gov">bwilliams@lc.usbr.gov</a>	702-293-8571	702-293-8042	PO Box 61470	Boulder City	NV	89006
Wolf	Aaron T.		Oregon State University	Associate Professor of Geography	Yes	<a href="mailto:wolfa@geo.orst.edu">wolfa@geo.orst.edu</a>	541-737-2722	541-737-1200	Dept of Geosciences, 104 Wilkinson Hall	Corvallis	OR	97331
Wolfe	Dick		State of Colorado	Chief of Water Supply		<a href="mailto:dick.wolfe@state.co.us">dick.wolfe@state.co.us</a>	303-866-3581, ext 8	303-866-3589	1313 Sherman St, Rm 818	Denver	CO	80203
Zagona	Edith		University of Colorado	Director, CADSWES	No	<a href="mailto:zagona@cadswes.colorado.edu">zagona@cadswes.colorado.edu</a>	303-492-2189	303-492-1347	Center for Advanced Decision Support for Water and Environmental Systems, Campus Box 421	Boulder	CO	80309